THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXVIII. No. 704.] LONDON, NOVEMBER 7, 1876. [28TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—12,000 cubic feet of gas per ton of coal: 28-candle gas; coke 66·70 per cent.; volatile matters 33·30 per cent. Coke of good quality.

RAMSAY'S PATENT CONDENSED GARESFIELD COKE.

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GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne.

Address G. H. RAMSAY, NEWCASTLE-ON-TYNE, London, at the Lombard Exchange, 39, LOMBARD ST., E.C.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT
(Mixed ready for use).

These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover far effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.

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WORKS: BRIXHAM, TORBAY.

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MANUFACTURER OF
WOOD GRIDS
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JOSEPH COWEN and CO.,
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Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

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Established at the commencement of Gas Lighting.
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Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
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ERECTION AND REBUILDING OF GAS AND WATER WORKS.
ESTIMATES FREE
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FOR THE ENGLISH GOVERNMENT
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Presented by Her Majesty's Government to the French Government,
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Warranted to Measure correctly & not to vary.

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TELEGRAPH TUBES OR POLES, &c., &c.

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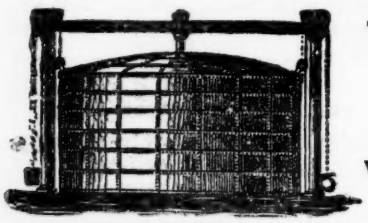

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REFERENCES TO UPWARDS OF 300 GAS-WORKS.

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WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

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DIXON'S CELEBRATED SELF-SUPPORTING IRON ROOFS are specially suitable for Forges, Rolling-Mills, Iron-Works, Shipbuilding Yards, Mines, Collieries, Gas and Water Works, and for general purposes.

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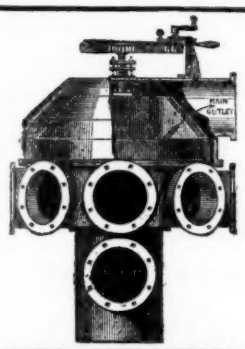
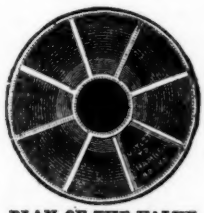
The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

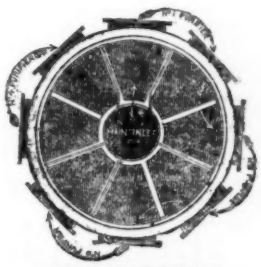
JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.



C. & W. WALKERS'

PATENT CENTRE-VALVES.





ELEVATION OF THE CENTRE-VALVE. PLAN OF THE VALVE. PLAN OF THE BODY.

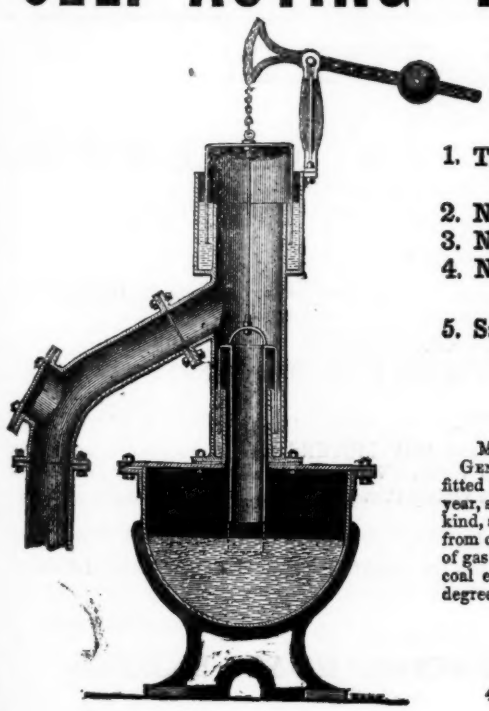
These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS. DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Tenby Gas-Works, March 29, 1876.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—In reply to your inquiry, I have to say that all the retorts at these works are fitted with your Self-Acting Patent Dip-Pipes. They have been in use now for more than a year, some for more than two years. They have never required repair or attention of any kind, and work admirably. By the use of these removable dips the retorts are kept quite free from carbon, the charges burn off more quickly than before they were adopted, and the yield of gas is increased. We get regularly a weekly and monthly average yield of gas per ton of coal exceeding 10,400 feet of 14-candle gas, and I attribute this excellent result in no small degree to the use of these Self-Acting Removable Dip-Pipes.

I am, gentlemen, yours faithfully,

(Signed) EDMUND H. STEVENSON.

For terms of use and cost, apply to Mr. C. W. STEVENSON,

4, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W.

THE

IMPERIAL METER COMPANY,

LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

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GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WILLEY AND FORD,

GAS ENGINEERS,

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INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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GAS ENGINEER,

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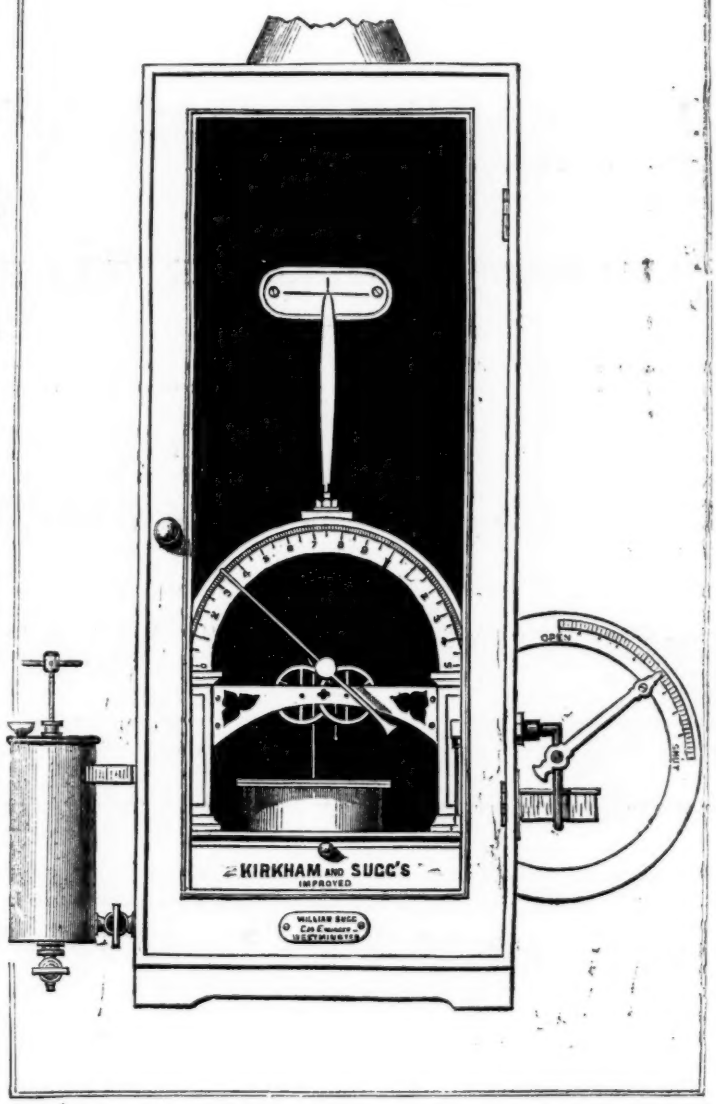
WESTMINSTER, S.W.

"EVANS"

Photometers,

which do not require a Dark Room, with every Fitting accurately made to Gauge, French Polished Bench and Drawers complete, as approved by the Gas Referees.

LOWE'S JET PHOTOMETER.



"LETHEBY"

Photometers,

with Fittings and Bench complete for Dark Room, as approved by the Gas Referees.

LOWE'S JET PHOTOMETER

(KIRKHAM AND SUGG'S IMPROVEMENTS),

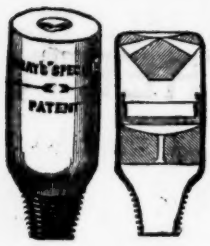
With new external Water-Line Regulator; Improved Micrometer, with Quadrant divided into 45 degrees; Valve, with *pro ratâ* opening; Improved Ventilator, Purple Glass Height of Flame Measurer; King's Gauge, working on Friction Rollers. In French Polished Pine Case. Diagram for ditto for finding the Illuminating Power in Candles.

PRICE £12 10s. COMPLETE.

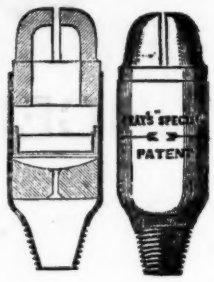
Can also be had with additional Scale on Pressure Gauge, to show by inspection the Illuminating Power in Sperm Candles, at a slight extra cost.

NOTE.—When an order is given for a Jet Photometer with this latter addition, it will be necessary to state about the quality of Gas for which it will be used. The range in candles will not be more than three or four.

PRICE LISTS WILL BE FORWARDED POST FREE ON APPLICATION.



BRAY'S
NEW
GAS-BURNERS.



BRAY'S "SPECIAL"
TRADE MARK.
PATENT.

A NEW FEATURE IN GAS LIGHTING.

OUR WELL-KNOWN

PATENT "ENAMEL" REGULATOR GAS-BURNERS

(UNION JETS AND BAT'S-WINGS)

Were designed as improvements on the common Burners, and that object has been so successfully attained that they have, we believe, met with more approval and recommendation from the Gas Engineering Profession and the Public than have been accorded to any other firm's make of Burners since the commencement of gas lighting.

Of the two kinds of Burners—the Union Jet and Bat's-wing—in general use, the latter is the least useful, because of its want of adaptability to general circumstances, and great liability to get out of order; but, when in good order, it has hitherto had the advantage of yielding more light with common and medium qualities of gas than the Union Jet. The Union Jet, on the other hand, has the advantage of greater adaptability, being useful everywhere, is less liable to get out of order, requires scarcely any attention, and will stand more rough usage. Notwithstanding these great practical advantages, which are almost everything in a Gas-Burner, Gas-Burner improvers have been attracted to the Bat's-wing, because of its giving a more showy result when tested for illuminating power only.

We have succeeded in improving both Bat's-wing and Union Jet Burners; but, while adding materially to the efficiency of the first-named, it is specially noteworthy that the Union Jet has received most advancement by these improvements. While retaining all the advantages of the Union Jet, we have brought it up in ILLUMINATING POWER to the level of the most expensive Bat's-wings specially got up for developing that feature. The result is such that we have no hesitation in pronouncing BRAY'S "SPECIAL" UNION JET

THE BEST BURNER HITHERTO PRODUCED,

AND

A NEW FEATURE IN GAS LIGHTING.

The leading features of this NEW UNION JET may be summarized as follows:—

It gives more light, from the smallest to the largest sizes, than any Union Jet was ever before known to give.

It gives 30 to 60 per cent. more light than the common Union Jets.

It gives as much light as the most expensive Bat's-wings specially constructed for high illuminating power, without the Bat's-wing's disadvantages.

Tested on the Photometer at various consumptions—say, 3, 4, and 5 feet of Gas per Hour, or any similar variation—and the results averaged, our New Burner will show a higher illuminating power than the best Argand. If the tests are made downwards and upwards as well as laterally, the results will be still more in favour of our New Burner.

ADDITIONAL ADVANTAGES possessed by our NEW BURNER over all others in the market, and these are applicable and are added to our IMPROVED BAT'S-WING:—

In all Burners having an arrangement for diminishing the flow of Gas before it arrives at the point of ignition, that part of the Burner which effects this object has been a source of weakness, because of its being placed in a position very liable to fracture, and easily tampered with. Indeed, this is so arranged that any one can get at and break or widen out the inlet for the Gas at pleasure, and make what ought to be an economical Burner a most extravagant one. In our New Burner, this part is so hard that it cannot be enlarged by drilling, and is so arranged that it cannot be otherwise tampered with without breaking up the whole Burner; this forming, we believe, the most efficient safeguard yet introduced against the extravagant use of Gas by those who have not to pay for it.

The Gas Supply being given through one ROUND hole, which is made through non-corrosive material, it is not so liable to stop up or get out of order as in cases where a number of small holes or narrow slits are used. When these holes are made through *metal*, the lasting property of the Burner so constructed is almost *nil*, even if the aperture is not tampered with.

There is no hissing noise caused by the passage of Gas through the diminishing arrangement of this Burner.

☞ All our "Special" Burners have our Trade Mark stamped on the sockets thus BRAY'S "SPECIAL" PATENT.

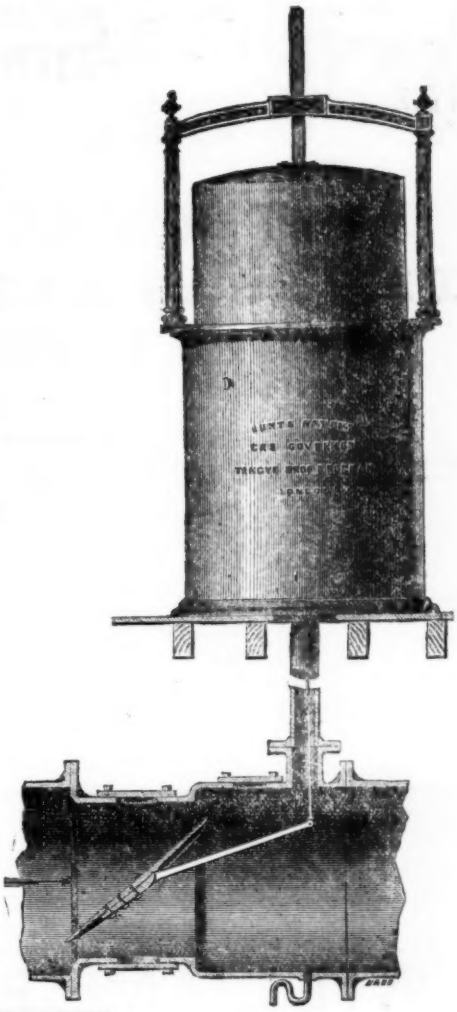
GEORGE BRAY & CO., BLACKMAN LANE, LEEDS.

TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS GOVERNOR.



In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by several leading Gas Companies, among whom are the following:—

The Gaslight Co.—two 36 in. at Blackfriars.
" " a 36 in. at Goswell Road.
" " a 24 in. at "
" " a 24 in. at Whitechapel.
" " an 18 in. at Bow Common.
" " a 24 in. at Beckton.
" " a 6 in. at "
The London Gas Co.—a 24 in. at Nine Elms.
" " an 18 in. at "
" " an 8 in. at "

The Exeter Gas-Works—a 24 in.
" Abergavenny Gas-Works—a 10 in.
" Birmingham Gaslight Co.—an 8 in.
" Monmouth Gas-Works—an 8 in.
" Devonport Gas-Works—an 8 in.
" Cannes Gas-Works—an 8 in.
" Mentone Gas-Works—an 8 in.
" Rochdale Gas-Works—a 4 in.
" Imperial Gas Co., a 12 in at Great Cambridge Street.

TESTIMONIAL.

The Gaslight and Coke Company, 9, Water Street, New Bridge Street, Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

VIENNA EXHIBITION, 1873.—The highest prize and only Medal "for Progress" for Direct-Acting Steam Pumps for general purposes was awarded to TANGYE BROTHERS AND HOLMAN, Engineers, London, for

THE "SPECIAL" DIRECT-ACTING STEAM PUMPS.

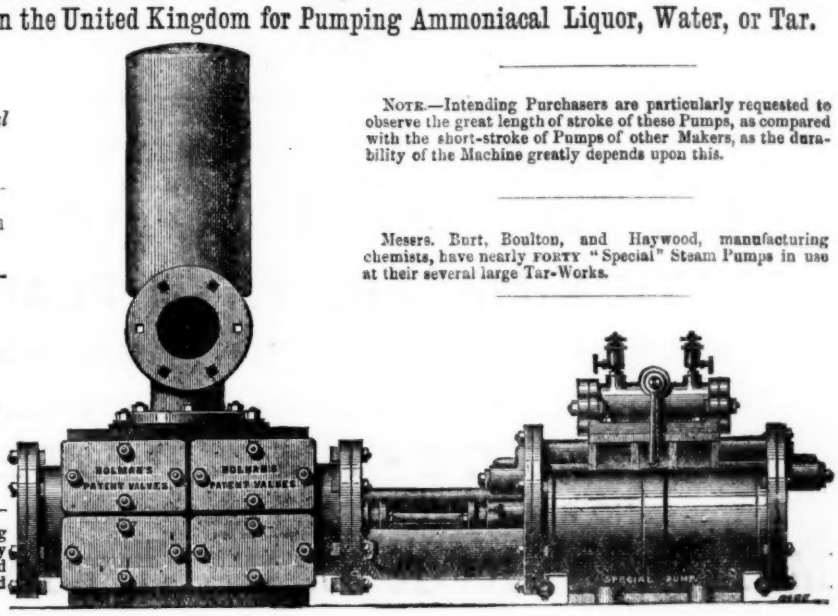
Upwards of 12,000 have been sold in England and America.

In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

The following are a few of the leading Sizes in use in Gas-Works and Chemical Works:—

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4*	2	9	815	18
3	3	9	1,830	18
5	2½	12	1,250	21
5*	3	12	1,830	22 10
4	4	12	3,250	25
6*	4	12	3,250	30
5	5	12	5,070	32 10
7*	5	12	5,070	40
6	6	12	7,330	40
8*	6	12	7,330	50
7	7	12	9,750	50
10*	7	12	9,750	65

* These sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance piece between steam and pump cylinder at a small extra cost.



NOTE.—Intending Purchasers are particularly requested to observe the great length of stroke of these Pumps, as compared with the short-stroke of Pumps of other Makers, as the durability of the Machine greatly depends upon this.

Messrs. Burt, Boulton, and Haywood, manufacturing chemists, have nearly FORTY "Special" Steam Pumps in use at their several large Tar-Works.

London 1851. New York, 1853 Paris, 1855. London, 1862.

Dublin, 1865

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 7, 1876.

Circular to Gas Companies.

The Metropolitan Municipal Association have again presented to the Home Secretary a memorial, praying him to take into consideration the necessity for a Municipality of London. Some very influential names were attached to the memorial. The movement evidently grows, and we shall not be surprised if the Government, in the absence of foreign disturbances, take up the question in earnest. There are few statesmen, at the present day, so well acquainted with municipal matters as Mr. Cross, and the business could hardly fall into more competent hands. The Association, in their memorial, call particular attention to the "administrative waste" in connexion with the gas and water supply of London, of course, with the object of showing that the supply of these two commodities should be in the hands of some municipal authority. Following the Registrar-General, or, rather, Dr. Farr, the cost of these articles is regarded as a tax, which we consider a mistake. Gas, at all events, is a manufactured commodity, the price of which must always be regulated by the cost of production. Water, though a natural element, costs money to obtain, store, and distribute, and the rate at which it can be supplied, depends on the charges incurred for the purposes named. No doubt, the Metropolis might be more cheaply supplied with water by a municipality, who put aside all consideration of profit. This is evidently Dr. Farr's opinion, for he writes: "In the absence of an adequate administrative body, "as London was supplied with water as the demand arose, so it "was also supplied with gas, and still pays an enormous tax on "these two commodities, with which it would have been supplied "at cost price, had it enjoyed the full advantage of an enlightened "Municipal Government." That is quite true; and we are glad to know that Dr. Farr shares our views as to the proper management of municipal gas and water undertakings. The supply of the two commodities at cost price would be a great blessing, and if an "enlightened municipal government" did nothing more, they would deserve the fervent gratitude of their constituents.

The Corporation of London and the Metropolitan Board of Works have, for the present, abandoned all idea of buying up the gas and water companies. They are just now busy with schemes which will about double the taxation of the metropolitan ratepayer. We do not object to this, for we feel bound to say that the expense will be incurred for very desirable improvements. Some objections might be made to the freeing of the toll-bridges at public expense, since the most material advantage is gained by the owners of property in the neighbourhood of the bridges, the value of which is considerably increased. But as regards all the schemes, we may express a hope that they will be sanctioned by Parliament, and duly carried out. The gross indebtedness of the Metropolis is, after all, relatively very small. We can afford to expend much more on public improvements; but we should be glad to see these made, not exactly with a view to profit, but on such a plan as to make them, as nearly as possible, costless. The bridges must necessarily be a burden on the ratepayers, and some loss must be sustained in carrying out schemes under the Artizans Dwellings Act. These, we believe, will be cheerfully borne, on account of the indubitable benefits which will be derived.

To return, however, to our text. We have peace in our time. The gas companies are to be let alone for a period. How can they utilize the time, and do something in preventing the "administrative waste," of which the Registrar-General complains? Clearly only by combination. The further efforts in this direction, which, we understand, are now being made, will, we hope, prove successful. The time is just now propitious for amalgamation. Reductions in price over the greater part of the Metropolis have quieted the agitators, and schemes which would have been opposed while prices were high, will now pass unchallenged. The wishes of the responsible organs of the Government have been clearly expressed, and although the Board of Trade are not likely to interfere in metropolitan gas matters at present, we know that amalgamation is the one thing thought desirable by that department. This view is, we are certain, shared by all enlightened friends of the gas companies, and recent events have led the most intelligent of the general public to regard further combination with favour. It is a significant fact, that the high-priced companies are now the two smallest in the Metropolis. In the case of neither does a reduction seem possible, so long as they remain isolated; in one, indeed, a heavy expenditure of capital, which must for some years be unproductive, would seem to postpone any reduction for an indefinite period. An outcry against high prices in some districts is certain to be shortly raised, and the only means of avoiding it is by amalgamation, and the prevention of "administrative waste."

There is one phase of the Dublin Gas Question to which we intended to refer in our last, but accidentally omitted the reference. It is the supply for public lights, to which our attention has been forcibly directed by the proceedings at recent meetings of the Dublin Corporation. At present a contract exists, by virtue of which the Alliance Company supply gas to public lamps, by average meter indication, at the rate of 3s. 11d. per 1000 feet. This charge, however, covers the expense of lighting, extinguishing, and cleansing, and, moreover, the interest on the plant, which cost the company about £60,000. Thus, it works out, that the net charge for gas is only about 3s., which is, in fact, rather less than cost price. Now, if public lights are supplied at a loss, the money must be made up in some way or another, and it is not surprising to find private consumers made to pay more than a fair charge to recoup losses sustained by a public supply at too low a rate. The contract expires at the end of the year, and negotiations are in progress for another. A continuation of the present price is, of course, impossible; and the Company now ask 4s. 3d. per 1000 feet, the Corporation being required to do the lighting, &c. We shall not say that the price is exorbitant. In this country, it is almost an universal law, that public lamps shall be supplied at the lowest rate paid by private consumers, except under special contract. On such an understanding, the Corporation of Dublin would do well to close the bargain at once, but we believe it is their intention to refer the matter to arbitration, under the terms of the Gas-Works Clauses Act, 1871, incorporated with the Company's Act of 1874. This will necessitate a thorough investigation of the Company's affairs; and, although there is really but little to learn, we may be somewhat enlightened. It seems to us that the production of gas per ton of coal is not all it might be. Then, considering the quality of the gas, the consumption of

expensive cannel coal looks excessive. These are, however, matters which we shall learn, seeing that they will probably be made the subject of inquiry. All we would say now is, that the Dublin consumer must pay, either "in meal or malt." If he gets gas in the public lamps at less than cost price, he must be content to pay more for what he privately consumes. With a fairer adjustment of price, certain benefits are sure to accrue, and we once again recommend the directors of the Alliance Company to devote all their efforts to effect a reduction of price. Dublin is, no doubt, an "early closing" city, and there is a prejudice against the use of gas in private houses; but who can say what influence dear gas has had in bringing about the early-closing movement, and fostering the prejudice?

Since the above was written, we have seen a report of the proceedings at a special meeting of the Corporation, held on Friday last. Dublin gas legislation seems to be in rather a confused state, but it is clear to us that the dispute must go to arbitration under the General Act. It would be most unfair to compel the Company to go on supplying the public lamps at the present rate.

The Local Board of Ely recently discussed a notable scheme. The venerable city is at present supplied with gas by a company who are, unfortunately, not under the protection of either a Special Act or a Provisional Order. Their position, therefore, is precarious, in face of an opposing local authority. Early in the year, the Board appointed a committee to consider and report on the supply. The committee reported in favour of setting up competing works. The plant of the present company, they say, cost £12,000; and works of the same size, with wonderfully improved appliances, can now be erected for £9000, or, at most, £10,000. Then follows an innocent calculation: "Gas-works pay ten per cent. Our £10,000 will produce £1000 a year; one-half of this we will devote towards the reduction of rates, and the other shall be applied towards paying off the money borrowed." Innocence of this kind is refreshing to witness, especially when exhibited in a Local Board. Nobody suggested the course the company would be likely to pursue when the competing works were established. The case of Manchester was freely quoted, but nobody referred to Limerick. The Corporation of Manchester, having had an extensive monopoly for very many years, make large profits by the supply of gas; the Corporation of Limerick, competing with a company, have, within a very few years, lost £35,000. No better result could be expected at Ely, and a majority on the Board showed their wisdom by refusing to adopt the report of the committee.

There are gas troubles at the antipodes. As regards gas supply, Melbourne appears to be in the same state as the Metropolis before the Act of 1860 was passed. There are three rival companies all endowed with some sort of legislative powers. The consequence is, that, as the chairman of the oldest company rather bitterly complains, a large amount of capital has been wasted in laying three mains, where one would suffice. Melbourne, like London, suffers from the want of a complete municipal government. This is so far advantageous to the companies, that there is no one body to harass them. Under these circumstances, it seems to us that the Melbourne Companies might do as their metropolitan ancestors did before 1860, and agree among themselves as to the districts they would respectively occupy. Everybody knows how advantageous the arrangement proved to the London Companies. Dividends quickly rose to ten per cent., and soon back dividends began to be paid. We commend these facts to the notice of our brethren in Australia. Our parliamentary draftsmen do not require advice; still, for the information of them and others, we will quote a clause from a Gas Bill now before the Legislative Assembly of Victoria:—

> As often as the accumulation of profits invested in the company's undertaking shall amount to such a sum as in the opinion of the directors of the company would be advisable to divide amongst the shareholders, the company may divide the said accumulation of profits, or any part thereof, *pro ratâ*, amongst the shareholders for the time being, by the issue of fully paid-up or partly paid-up shares.

Such a simple manner of providing for the capitalization of expended profits we do not think has ever been devised.

The gas accounts of the Corporation of Aberdeen, for the past year, exhibit very satisfactory results. Last year a small loss was sustained, but this year the Corporation have £9703 to the good. Under these circumstances, they have reduced the price of gas 3d. per 1000 feet—from 4s. 10d. to 4s. 7d.

Water and Sanitary Notes.

The accounts of the Metropolitan Water Companies have just been issued, and we shall, as early as possible, furnish our usual abstract.

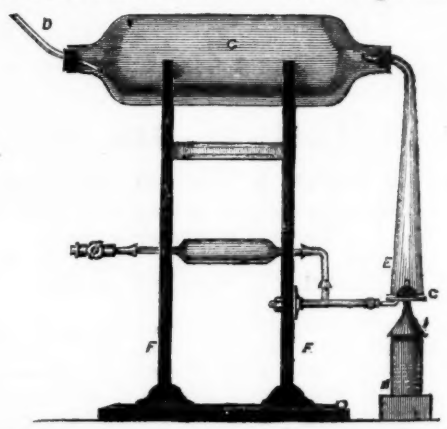
Mr. T. J. Nelson, the Solicitor to the Corporation of the City of London, and Chairman of the Hampton Wick Local Board, is pursuing his laudable endeavour to persuade the Local Government Board to constitute, by Provisional Order, a combined drainage scheme. He has succeeded in getting the Richmond Select Vestry to join him in the enterprise, and, at the invitation of Colonel Cox, a conference of delegates from the authorities concerned was held to consider the matter. Of course, no agreement was come to. Most of the Boards are waiting for a scheme, and until one is forced upon them, they will do nothing. There will be a further inquiry by the Local Government Board; but Colonel Cox warned the delegates not to wait for a report from him, but to push on works on plans of their own as fast as they could. This must have been disappointing to his hearers, who probably assembled in the hope of receiving some authoritative teaching. In the meantime, Messrs. Russ and Minns have proposed a plan for dealing with the sewage of the greater part of the districts it is proposed to combine. The scheme appears to us at first sight to have much merit; but we have not yet had time to make ourselves acquainted with the details. It certainly looks cheap, involving an annual outlay of only £9600, a part of which may be recouped by the rent of a farm of 150 acres, on which the sewage is to be treated on the intermittent downward filtration system. The net expenditure the proprietors estimate, will only involve a rate of 3d. in the pound. This looks a very small rate; but, when the inhabitants of a large part of the district find cesspools answer their purpose perfectly well, they will naturally object to rates altogether. Equal rating, too, we believe, would be found to press very unfairly on the several districts. It is, however, needless to speculate. The settlement of the question of the drainage of that part of the Thames valley is as far off as ever.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXVI.

Gas Testing (*continued*).

Dr. Letheby's sulphur testing apparatus, figured below, is too well known to need a long description. In principle, this instrument and that devised by Mr. Evans are exactly alike. The object of both is to effect the combustion of a small amount of gas in the presence of ammonia. In Dr. Letheby's apparatus, the Leslie burner is employed, and the supply of gas should be so regulated that a mere point of white appears above the blue flame. At this rate about 20 feet will be consumed in the 24 hours. A vessel (it may be a beaker or a wide-mouthed bottle), containing about four ounces of the strongest solution of ammonia (sp. gr. ·880), is placed underneath the burner, and covered with an inverted funnel, the stem of which rises through the centre of the burner to about an inch above the gas flame.



The apparatus consists of a glass cylinder, C, 13 inches long and 4½ inches in diameter, supported upon a wooden stand, F, and having a neck at each end 2 inches long and 2 inches in diameter. Into one of these necks is fitted, by means of a turned and bored cork, a tube, D, 4 feet in length and ⅜-inch bore, and bent so as to incline upwards at about an angle of 45 degrees. Into the opposite neck is fitted a trumpet-shaped tube, E, three-quarters of an inch in diameter at the upper, and 3 inches diameter at the lower end, within which is the Leslie burner, G. Beneath the burner is a vessel, H, to contain the solution of ammonia covered by the inverted funnel, I.

The successful use of this apparatus requires a few precautions. In the first place, the mouth of the trumpet-tube should be brought carefully to a level on the chimney-rests of the burner. Further, it is essential that the mouth of the tube and burner be carefully protected from draughts, which may, and do, in fact, blow a part of the products of combustion out of the trumpet-tube.*

* An experiment made by the writer, in which two apparatuses were employed—one being placed near a door left partially open, and the current of air directed towards the burner, while the other was in a different part of the room, carefully protected from draught—showed a difference of 40 per cent. in the "sulphur" obtained, the same gas, of course, being employed and burned for the same time.

The latest improvement in this apparatus made by Dr. Letheby was placing a disc of tin (perforated so as to allow the stem of the funnel to pass) close under the burner. By this addition all access of draught to the trumpet-tube is prevented, and, with this arrangement, the amount of sulphur obtained by the apparatus will be found closely parallel to that obtained by the Referees apparatus.*

The directions given by the Referees for the determination of the sulphur in the condensed liquor and washings will, of course, apply in this case as in the other.

Besides the sulphur apparatus, our illustration shows the arrangement of an ammonia-tube precisely the same as that of the Referees, and to be used in the same manner.

The sulphur test devised by Mr. A. Vernon Harcourt was described by him in a lecture, which will be found reported in the JOURNAL OF GAS LIGHTING, &c., vol. xxvi., p. 265.

The methods which have been described for the practical estimation of the sulphur and ammonia in coal gas, are those which should always be adopted where great accuracy is needed, and where the question of legal penalties may be involved. In many cases, however, it may be difficult or inconvenient for the gas manager to follow the prescribed methods, and we therefore append modes by which the sulphur and ammonia may be estimated with great simplicity of manipulation, and with very little trouble.

For the estimation of sulphur, the liquid obtained from the combustion in the ordinary sulphur test of a specified quantity of the gas under examination, is evaporated in a small porcelain basin, and when the contents are nearly dry, the whole is transferred to an air-bath, and the thorough drying accomplished at a temperature of about 240° Fahr. The basin and its contents are then allowed to cool, and subsequently counterpoised in the balance; and in order to be quite certain that all adhering moisture has been expelled, the basin may be replaced in the air-bath for a few minutes, and then withdrawn, and re-weighed, when the weight should be found the same as before. The contents of the basin, which consist of sulphate of ammonia, with an infinitesimal part of tarry matter, should now be removed by solution in water, and, after being thoroughly cleaned and dried, the basin may be again placed in the balance, and equilibrium restored by the addition of weights; when, from the weight so found, the quantity of sulphur present may be calculated in the following way:—Supposing, for instance, that 12·5 grains have been obtained,

132	:	32	::	12·5	:	x.
(Equivalent weight of ammonium sulphate.)		(Equivalent weight of sulphur.)				

$$x = 3{\cdot}03 \text{ grains.}$$

Note.—By the old notation the equivalent weight of ammonium sulphate would be 66, and that of sulphur 16.

The ammonia is estimated by placing a little dilute hydrochloric acid, which need not be of any particular strength, in the ammonia tube, passing the gas as usual, and subsequently washing out the ammonium chloride, which has been formed, by distilled water, and evaporating the solution so obtained in a porcelain basin, placed on the water-bath. It is necessary to conduct the evaporation with greater care and more slowly than when performing a sulphur experiment, for the reason that ammonium chloride is partially dissociated, and would be, therefore, more liable to loss during the evaporation, unless suitable precautions were taken to guard against this source of error.

When the ammonium chloride is thoroughly dry, the basin containing it may be removed from the water-bath, the outside of the basin freed from adhering moisture by a clean cloth, and, finally, the weight of the salt obtained. The following calculation will then give the quantity of ammonia present:—Suppose that 1·0 grain was obtained,

53·5	:	17	::	1	:	x
(Equivalent weight of ammonium chloride.)		(Equivalent weight of ammonia.)				

$$x = 0{\cdot}31$$

When, as is the case in the Metropolis, gas companies are liable to heavy forfeitures from small differences in illuminating power and the amount of impurities, strict accuracy in details becomes of the utmost importance. The Referees, therefore, very properly direct that the meters shall be tested at least once in seven days, which is to be done in the way described below.

THE GAS REFEREES CUBIC-FOOT MEASURE.

Description of the Cubic-Foot Measure; the method of fixing it; and directions for verifying the accuracy of the Meters connected with the Photometers, and also with the Sulphur and Ammonia Tests.

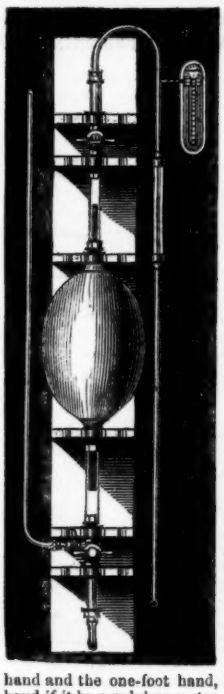
I.

This instrument is a vessel in form like an elongated egg, made of hardened tin, about one quarter of an inch thick, fitted at each end with a narrow glass tube, the joints being made sound with india-rubber packing. The instrument stands in a vertical position firmly fixed to a strong plank.

At the top of the instrument is a three-way cock, marked on the head of the key with a T, each arm of which shows the direction of a way through the plug; and in the side of this cock there is a small hole or vent, which serves to admit the air when the measure is to be emptied of water. When the T is in its ordinary position, communication is closed between the measure and the tube leading from it to the meters, but is open to the external air; with the T in this position (*i.e.*, with the stem pointing to the *opposite* side of the cock to that in which the vent is drilled) the measure is open to the meters and shut to the air.

At the bottom of the instrument there are two cocks—the small one, when opened, admits water into the measure; the large one, when opened, allows the water to be run off. The former of these cocks is provided with a lever-key, in order to regulate with greater nicety the entrance of the water into the measure.

* A difference of from 8 to 12 per cent. has been claimed in favour of the Referees apparatus, but the experiments were made without the use of the disc mentioned above.



The cock at the top of the measure is continued by a tin pipe in the form of an arch (bending down to meet the pipe leading to the meters); and at the further end of the arch there is a piece of glass tube, in which a thermometer is hung to show the temperature of the air passing from the measure into the meter.

Affixed round each of the glass tubes fitted to the upper and lower part of the measure there is a narrow strip of paper, which indicates the exact measure of one cubic foot, as tested by the Exchequer standard cubic-foot bottle, the upper edge of both strips of paper being the true water-line of the measure.

II.

The instrument should be in communication with a tank of water fed by a self-acting supply.

The lower water-level of the tank should be even with the top of the strip of paper marking the "full" line of the vessel; and it is advantageous that the upper water-level should be below the plug of the three-way cock on the measure.

III.

To verify the meters employed in ascertaining the consumption of gas in the photometers, or those employed in the sulphur and ammonia tests, the mode of procedure is as follows:—

Turn the three-way cock at the top of the instrument so as to leave the vent open to the air; and shut the large cock at the bottom of the apparatus. Then open the small lever-cock, and allow sufficient water to flow in to fill the lower glass tube up to the water-line. Then turn the upper cock so as to close the vent, while opening the way to the meters.

Next open the cock of the meter which is to be tested, taking care that all the other meters are closed to the cubic-foot measure. Note the exact position of the index hands—*i.e.*, both the long hand and the one-foot hand, if it be a photometer meter, or simply the long hand if it be a sulphur meter.

When all is ready, open a communication between the outlet of the meter and the air, at the same time taking care that all the pressure-gauge cocks are closed. Then proceed gently to open the small lever-cock, and allow the water to flow into the measure, just fast enough to raise the pressure in the syphon pressure-gauge fixed alongside, and in communication with the measure, from half an inch to three-quarters. This precaution is necessary to prevent the water being blown out of the meter by excessive pressure.

A meter attached to the photometer should make twelve revolutions of the long hand, and consequently one of the cubic-foot hand, by the time the measure is full up to the strip of paper on the upper glass tube. A meter connected with the sulphur test should, in the same time, make one revolution of the long hand.

Should the meter complete the prescribed number of revolutions before the measure is full, then some water must be removed from the meter; if the contrary is the case, then water must be added to the meter. The testing is then to be repeated until the meter is found to register correctly.

The dial of the photometer meters is divided into 50 divisions; and as each revolution indicates one-twelfth of a foot, each division consequently represents the $\frac{1}{600}$th part of a cubic foot; and, therefore, six of those divisions represent one per cent.

The dial of the sulphur meters is divided into 100 parts; and as each complete revolution indicates one foot, each division consequently represents one per cent.

The difference of an ounce in the quantity of water in the meters will make them register about one per cent., either fast or slow.

When the temperature of the cubic-foot measure is higher than the temperature at the outlet of the meter, the meter (if correct) will register a smaller quantity than has actually passed to it from the measure; when the temperature of the measure is lower than that of the meter, the quantity registered ought to be greater. Thus—

When the Cubic-Foot Measure is Warmer than the Outlet of the Meter by

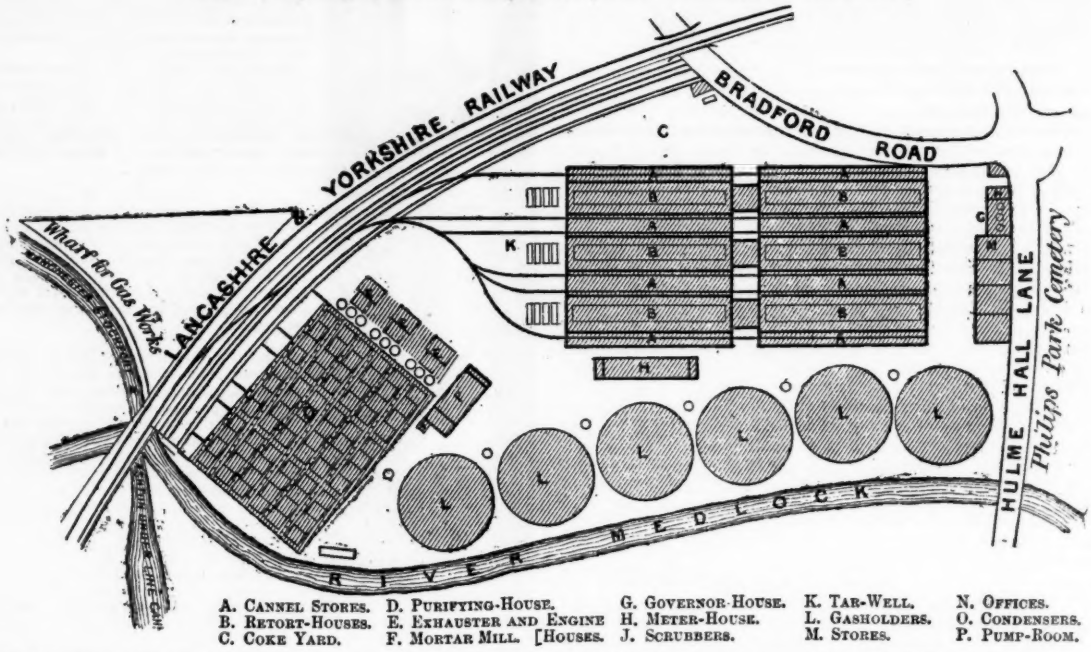
1 deg. Fahr.,	one foot	should register	on the	meter only	·998
2	,,	,,	,,	,,	·996
3	,,	,,	,,	,,	·994
4	,,	,,	,,	,,	·992
5	,,	,,	,,	,,	·990
6	,,	,,	,,	,,	·988
7	,,	,,	,,	,,	·986
8	,,	,,	,,	,,	·984
9	,,	,,	,,	,,	·982
10	,,	,,	,,	,,	·980
11	,,	,,	,,	,,	·978
12	,,	,,	,,	,,	·976
13	,,	,,	,,	,,	·974
14	,,	,,	,,	,,	·972
15	,,	,,	,,	,,	·971
16	,,	,,	,,	,,	·969
17	,,	,,	,,	,,	·967
18	,,	,,	,,	,,	·965
19	,,	,,	,,	,,	·963
20	,,	,,	,,	,,	·961

When the Cubic-Foot Measure is Colder than the Outlet of the Meter by

1 deg. Fahr.,	one foot	should register	on the	meter	1·002
2	,,	,,	,,	,,	1·004
3	,,	,,	,,	,,	1·006
4	,,	,,	,,	,,	1·008
5	,,	,,	,,	,,	1·010
6	,,	,,	,,	,,	1·012
7	,,	,,	,,	,,	1·014
8	,,	,,	,,	,,	1·016
9	,,	,,	,,	,,	1·018
10	,,	,,	,,	,,	1·020
11	,,	,,	,,	,,	1·022
12	,,	,,	,,	,,	1·024
13	,,	,,	,,	,,	1·026
14	,,	,,	,,	,,	1·028
15	,,	,,	,,	,,	1·030
16	,,	,,	,,	,,	1·032
17	,,	,,	,,	,,	1·034
18	,,	,,	,,	,,	1·036
19	,,	,,	,,	,,	1·038
20	,,	,,	,,	,,	1·040

MANCHESTER NEW GAS-WORKS.

DESIGN BY MR. T. NEWBIGGING, MANCHESTER. ("CLARIOR E TENEBRIS.")



A. Cannel Stores. B. Retort-Houses. C. Coke Yard. D. Purifying-House. E. Exhauster and Engine [Houses. F. Mortar Mill. G. Governor-House. H. Meter-House. J. Scrubbers. K. Tar-Well. L. Gasholders. M. Stores. N. Offices. O. Condensers. P. Pump-Room.

On the important subject of the supply of cannel to the retort-houses, we have much to say, and we cannot do better than draw attention to the difference in this respect between the three premiated designs, the plans of which we have given as illustrations. It requires no argument to show that the third is the best by far.

The engine for the special use of the gas-works, alluded to as part of the plant in several of the schemes, would work the trains of trucks to whichever side of the retort-houses cannel was required.

If we take the first design, we have, as shown on the plan, rails for the coal store in the centre and on one side only of each double retort-house; this, of course, suggests that they can be put on the other side if you please, and thus complete the good arrangement which is worked out in part; but we have also, in this design, turntables that greatly increase the labour in the removal of these trucks, and would be a material obstacle in utilizing to the full the locomotive which forms part of the plant. We feel assured this will be remedied in practice, for no one who knows the difference between the action of the one and the other will use a turntable if he can help it. The second design by "Thorough" does not contrast favourably with either the first or third in this matter of supply, for the direct communication between the railway and the retort-houses is wanting. With the best possible arrangement for moving the coal there would be a constant outlay in labour and renewal of plant seriously militating against the economical working of this design.

The stage gives the third premiated design an advantage, in our opinion, over the first, in drawing the retorts, and in slaking and removing the coke. This is a point that has often been discussed in considering these two different modes of structure, but it is more specially advantageous in a confined site. In both these designs the coke is proposed to be moved by means of hoists, in one form or other, to the rails.

The arrangement proposed by "Thorough" for moving the coke has already been given in a quotation from the description which accompanies the design. "An endless wire band is to be used, constantly revolving, to receive the coke as drawn." We are obliged, as in all others, to consider the scheme as it would be if complete. As these houses would be about 1200 feet from end to end, we should have a total length of twice 1200 feet of wire band four times over, working in subways communicating with each other, "receiving the coke, and conveying it to the south-west angle of the land." It must be borne in mind, we have not to deal with an ordinary quantity, but when in full work with the coke resulting from the carbonizing of upwards of 1600 tons daily.

Our practical readers will form their own judgment on the efficiency of this scheme for removing the coke. We think it and the defective means of supply are features in this design in unhappy combination. The means of supply in "Clarior e Tenebris" are almost identical with the arrangement shown in "Omne Trinum Perfectum," while in "John Dalton," "Hope," "Il Penseroso," "Asterisk," and "S. M.," the houses are at right angles to the rails, from which the trucks would enter the houses by curves without turntables, and in "John Dalton" and "Il Penseroso," the coke would be drawn from the opposite end, and in one or both of these designs, without any extraneous mechanical appliance, would be removed by an incline to the rails of the Miles Platting siding, or to the wharf by the little engine attached to the works. The expedients for raising the coke to the higher level are most varied, one even has a lift adapted for raising the locomotive previously referred to, the desirability of using it for coke as well as cannel, on the upper and lower levels, being foreseen.

The various kinds of apparatus for condensing shown and described in these designs are better fitted for our "Treatise on the Science and Practice of Gas Manufacture" than for this article, but we cannot avoid some remarks. We have in "Hydrocarbon" a water condenser over the coal stores—a very bold expedient in a confined site, but which we think will be troublesome in practice. We have them horizontal, vertical, and annular, with pipes of various sizes; and, in the design by "John Dalton," we have both air and water condensers in combination. Had we seen this last-mentioned with only its synonym, we should have been disposed to doubt the practical experience of its author, whatever other good points we might have seen in the design; for the condensing appliances cover a larger area than in any other scheme, although the make is less than in the majority. But when we see attached to it the name of one who is known as one of the most experienced gas engineers in the management of large works in the country, and whose improvements in gas manufacture have been applied all over the world, we hesitate before we condemn an extravagance in this particular, the reason for which is not fully apparent to us. A few words which we read, attached to another design, relative to cooling the gas gradually to the temperature of the atmosphere, may give a clue to the reason for this elaborate condensing arrangement; but we raise the question whether this gradual cooling has not been overdone by "John Dalton," and also whether that of "Hydrocarbon" will not be too rapid and forced, and cause the gas to lose brilliancy, for this is really the *crux* of the whole matter, and a point on which experience only can decide.

The important process of removing from the crude gas the several impurities is also met in various ways. We have Mr. Burns's scheme, which states that he proposes a system which differs from any now in use. We cannot here discuss the value of what he proposes; we can only take a broad view, and affirm that the extensive works proposed for Manchester cannot be made the field for a large experiment.

One design introduces purification by lime only, in small purifiers 11 feet square. Where the lime is to be taken to after it has been used, in densely-populated Lancashire, we cannot imagine. Many propose oxide and lime in combination; some—"Hydrocarbon," for instance—do not distinctly specify what process is to be used; while many others distinctly state oxide of iron alone. In one of these—"More Light"—the stream of gas is to be admitted by two inlets, one at the top and one at the bottom, the outlet being in the centre. This, be it remarked, is a process that has been patented. This purification raises the question whether removing the sulphur compounds, other than sulphuretted hydrogen, is worth the cost. This is a most important point in connexion with these gas-works for Manchester, on account of the larger area that will necessarily be required if purification by lime, in addition to oxide, be insisted upon. It places those gentlemen who have adopted it at a disadvantage; for, assuming the areas of the purifiers to be computed according to modern practice, it diminishes the capacity of their works. What is done in London cannot be taken as a definite guide for Manchester. Here the private gas companies are in antagonism with several public local bodies, and an impurity of the slightest character has to be guarded against under penalties which their opponents have been able to insert in their Acts of Parliament, while in Manchester the corporation have all in their own hands, and can elect what course to pursue. We do not remember in any design that there was a proposition to place these purifiers in the open, without a roof; but we have them on an upper floor, the space under being used for revivifying, and we have in others a floor over them used for such purpose, and, in one case, two floors. In two designs or more we have means for introducing and removing

material by rail direct. We have, in the design by "Asterisk," the purifying-houses injudiciously placed contiguous to the retort-houses. In "Hydrocarbon" and others a road separates them from each other. We need not inform the readers of this JOURNAL that they must be kept away from the fire, the danger being such that they are only entered after dark with safety-lamps.

This contiguity, in our opinion, would be sufficient to reject an otherwise well-arranged scheme.

In only one design, that by "John Dalton," did we observe that check purifiers were provided. This is an expedient that has been found necessary at the new works at Beckton, and we apprehend it will be regarded as equally important in Manchester. The object is to remove from the gas, after passing the meters, before it reaches the gasholders, the last trace of impurity that may have escaped the previous process, either through the leakage of a valve or in changing the purifiers.

The capacity of the tanks for tar and liquor, and the means for removing these residuals, are points, the importance of which has been overlooked in many designs. In these particulars, the third design takes place far before the first. These tanks, in "Hydrocarbon," are very limited, whereas they should be most ample, for every ton of coal carbonized is known to yield 30 gallons of liquid products, and, therefore, requires in a tank, 5 cubic feet of space. "Totaque Vagatur Urbe" has provided tanks for nearly one million gallons, while "Clarior e Tenebris" has provided for 1,700,000 gallons, being equivalent to his maximum make of 40 days.

In these designs there is a diversity of arrangement with respect to the meter-houses, and also in the mode in which the gas is measured. Special mention is made, in the description by "John Dalton," to the streams of gas being kept separate until they have passed the meter-house, so as to compare the production of one retort-house with that of any other, the importance of which in a large establishment need scarcely be enforced.

In many designs, among them "Hydrocarbon," gasholders are proposed in three lifts. A gasholder of this construction was first introduced, and with comparative success, in the works of the City Gas Company, at Whitefriars, where, as ground could not be purchased, the required capacity had to be obtained upwards. This gasholder has been given as an illustration in the JOURNAL. We are advised, however, that it is one of those expedients that can only be justified by an urgent necessity, and should never be adopted in new works. The care necessary to keep the cups in winter in proper working order entails constant attention, and Mr. Mann—"John Dalton"—the first to use one, ignores them in this competition. In Manchester, where frosts are of longer duration and of greater intensity, they would be particularly troublesome. We think it would have been wiser if "Hydrocarbon," instead of having a number of small holders, had adopted the modern expedient of holders of large size and two well-proportioned lifts.

We have already stated that the great drawback in the design by "Hydrocarbon," as a practical scheme in its entirety, is putting too much on the ground. In no single particular would this be felt more, by one who had charge of the works, if built, than in having no place of any size to store the various materials that must be put somewhere. Retorts, pipes of various sizes, fire-bricks, and the like, for these immense works, would require a very large area, which we do not see is provided anywhere. It is true railway and canal adjoin, giving facilities for transport; but these things are required on the spot, in large bulk.

Having thus, at some length, examined the arrangements shown on the drawings, we must briefly allude to the descriptions which accompany them.

These, in some cases, are of the most meagre character, and in others are given with very full details. That attached to "Totaque Vagatur Urbe" is very full in detailing the capacity of the several portions provided, and those of "Clarior e Tenebris," "SH + SO_3," and Mr. Hodgson Jones, are very fully detailed; but we are not alone in our opinion, that the most completely detailed scheme of gas manufacture, and the several necessary appliances according to modern practice, is in the description attached to the design by "John Dalton." It is complete in every particular, from the introduction of the cannel into the works, to the governor, with its bye-pass, on the gas leaving them; and this could be said of none other. We have given a very decided opinion respecting the best plan, and we are equally as decided respecting the best scheme for gas-making. We fear, in this case, too much time has been devoted in elaborating a scheme, and too little in putting it on paper.

In many of these designs, proper attention has been given to the comfort of the workmen. "Clarior e Tenebris" has baths; "Hydrocarbon" has a canteen, as in a barrack; "Thorough" has a mess-room to each section; and several others might be mentioned, if it were necessary.

The offices, laboratory, and the like, require but little comment. We observe in "Hydrocarbon" a more complete arrangement than is usual for conducting experiments; but we failed to observe, in by far the greater number, provision for stabling.

To structural details, which follow as matters of course, we gave but little attention. We noticed, however, that some in their gasholders proposed to abandon the trussed crown, and to adopt instead what to us appears much more scientific—arched ribs springing from the inner annulus of the cup.

In none of the designs did we see it proposed to build the gasholder-tanks with a concrete backing. In one, if our memory serves us, an iron tank was provided, from a belief, we should presume, that the ground is not so stable as could be desired; but in the others, or, at all events, the larger majority, the tanks were proposed to be built with the usual brickwork in cement, with clay puddle.

If we apply to these designs a test which above all others is the most searching, and assume that the works, when built, have to be let on a lease, with the usual covenants to repair, support, uphold, maintain, and on the determination of such lease to deliver up the buildings and plant in good order and condition, fit for the use of an incoming lessee, "Hydrocarbon," under such circumstances, with all its crowding, will hold its position in a very marked and decided manner, and those designs, which have the most simple expedients, would have the advantage over those with mechanical appliances.

In conclusion, we cannot help expressing a regret that so many schemes only show what to avoid, and that so many drawings are but little better than waste paper. They are useful only to illustrate the statement that the Gas Committee have required too much, and we are persuaded this will be fully understood before any contracts are entered into. We shall take special interest in watching the progress of these large works, and from time to time report what has been done.

Descriptions of some of these designs were promised to be sent us from the authors, when the drawings were returned, and we have been unwillingly obliged to give them without this additional information. We are surprised these drawings are still retained in Manchester. They were sent in on the 21st of March, and more than two months have elapsed since the award was announced. We should have thought the Gas Committee would have felt that after making the award the drawings should have been returned immediately, and if any particulars had been desired respecting them, or any information required which these designs conveyed, their authors should have been communicated with.

Correspondence.

BACK DIVIDENDS *VERSUS* RESERVE-FUNDS.

SIR,—In your comments upon my letter on this subject, in your JOURNAL of Tuesday last, you say: "We have heard it argued that the dividends attach to the scrip, and not to the holders." I am not quite sure that I see clearly the object of this remark, but I fully agree with the remark itself. Shares are personal property, and the moment any one parts with his share, he ceases to have any right, title, claim, or interest in it whatsoever. All that is transferred with the share to the purchaser, in the same way, and to the same extent, as it would be with any other article purchased in a shop, and taken away at the time of purchase. This, however, does not help us out of the difficulty; but, on the contrary, creates it. The Act says the profits to be divided among the shareholders shall not in any year exceed 10 per cent., unless a larger dividend be at any time necessary to make up the deficiency of any previous dividend which may have fallen short of that rate.

A company with a surplus and no reserve might have original shares upon which, for many previous years, the dividend had not been more than 5 or 6 per cent., and new shares upon which the dividend had been 10 per cent. for the whole time they had been in existence.

The original shares, under such circumstances, would be entitled to have the "deficiency" made up, and consequently might be supposed to have some valuable contingency attaching to them; but what claim could the new shares have to any "deficiency"?

All ordinary shares are entitled to an equal rateable proportion of the profits made in their time. If, however, any surplus, under the circumstances before described, were to be distributed rateably among both the old and new shares, the new shares would have more than they were by law entitled to, and if it were to be distributed among the old shares only, the old shares would have a larger proportion of the profits than the new. The first course would doubtless be illegal, but the second might be adopted if the consent of all the new shareholders could be previously obtained, and the amount appropriated was not more than sufficient to make up the actual deficiency. But it must not be forgotten that, when the law has conferred certain rights upon shareholders, it is not in the power of a general meeting to override those rights, and, consequently, any individual proprietor objecting, might put a stop to it, whereas if the surplus were appropriated to the reserve-fund, which would benefit all alike, none of these questions would arise.

W. LIVESEY.

Gas and Water Companies Association, 6, Victoria Street, Westminster, Nov. 1, 1876.

SIR,—There is a very simple question before your readers—*i.e.*, Is it legal for gas companies, with parliamentary power, to pay the balance of their unpaid "back" dividends? It occurs to me that such a simple question would beget a simple answer, supported with the necessary Act, cap. and sec., and when this had been supplied it would show more discretion to leave the matter in the hands of the directors. Your correspondent states that "some persons entertain the idea that, if the dividend at one time has been only 5 per cent., it may at some other time be 15 per cent.," and then runs off to a long explanation of what is the case. May I ask—Is there a gas director, manager, or secretary who does hold such an opinion? I personally know several, but fortunately, or unfortunately for your correspondent, their ideas are not in unison with his.

Your correspondent writes: "Admitting then, for argument, that £1000 is all a company would rightfully take, how would that £1000 have to be dealt with?" And further states that "no one section or class of shareholders can claim any larger portion of the profits than another." Let us see what the 31st section of the 1847 Act says: "If the clear profits of the undertaking in any year amount to a larger sum than is sufficient, after making up the deficiency in the dividends of any previous year as aforesaid." This should, I believe, be interpreted thus: The making up the deficiency, or balance, of the maximum dividend allowed, only upon the paid-up capital of the period when the deficiency arose, and so on, period by period, taking into consideration any further capital that might have been paid up in any such period or periods, until all the balance of back dividends had been liquidated; therefore

the holders of those shares, that had not received their full dividends, are entitled. "Shares are always sold with all their rights, privileges, and liabilities." I will take your correspondent's Mr. A. and Mr. B. theory, and ask him if it is not usual, in buying bonds—Spanish, for instance—the coupons of which had not been paid for several years, if they do not go with the purchase, and are they not reckoned in the consideration money?

Your correspondent wishes to prove that it is not justifiable, and afterwards states that "it is questionable whether it is ever good management." If it is not justifiable, one cannot entertain the question of "good management," and if one entertains the question of "good management," why try to prove that it is not justifiable? But I must here reiterate that the question is one that should be left to the discretion of the board of directors, as circumstances must, will, and do alter cases.

GEORGE SANDELL.

4, *Skinner's Place, Size Lane, London, E.C., Nov.* 3, 1876.

GAS ANALYSIS.

SIR,—Finding, from the progress of the able "Treatise" on gas manufacture, now being printed in the JOURNAL, that the Editor was approaching the topic of "Gas Testing," I waited patiently to see how he would dispose of my objections to the methods followed by the "Instructions" from the Gas Referees in correcting the value of the illuminating power found at any given time by the photometer, to certain hypothetical conditions of atmospheric temperature and pressure, which might widely differ from those prevailing at the time the gas is being tested and used by the consumer.

My objections were fully given in the communications you kindly permitted to appear in the JOURNAL several months ago, since which time I have found my views of the question to be fully shared in by many of my fellow-managers in Scotland, who, with myself, did look for an authoritative opinion on the subject in the latest general "Treatise" on gas lighting, which we will all expect to possess the most correct views on gas subjects to the present date. It is disappointing to find that the subject is entirely avoided in the chapter on "Gas Testing," where, if there is anything of general interest in the question at all, it might be disposed of by the writer.

If, as I believe, it is unfair to gas companies to have the gas they supply in cold weather reduced in nominal candle power by calculations to a temperature of 60°, the extent of such injustice applies to 80 or 90 per cent. of all the gas supplied annually in such a climate as we have in this country.

A. MICAWBER, Jun.

Glenmutchkin, Nov. 2, 1876.

REMOVABLE DIP-PIPES.

SIR,—Will you be good enough to allow us a little space in your JOURNAL to put a question, and express an opinion upon a matter which, to all connected in any way whatever with gas manufacture and management, is alike interesting and important—Whether is the hydraulic seal, however small, during the carbonization of the coal, desirable or not?

When gas manufacture was in embryo, if any one had expressed an opinion that a seal of 6 inches in the hydraulic main might be reduced a little, without increasing the liability to accident, he would have been looked upon with a degree of suspicion and ridicule; although, since then, perhaps by slow degrees, we have been induced to reduce the depth of dip; and it must be admitted that, as each step has been taken, the result has been a less deposit of carbon, and, consequently, an increase in the yield.

It is obvious that, if a 6-inch dip is a great obstruction, by maintaining a 2-inch seal (which is thought by many to be the minimum of safe working) we have only reduced that obstruction by two-thirds. The question arises, can we reduce the 2-inch seal by three-fourths (which is suggested by men of no mean standing), leaving us half an inch only, and feel confident that no accident can happen through a non-sufficient seal. Most emphatically, in our opinion, we say *No*, except as in the case of the Chandler and Stevenson's self-acting dip, which can be so regulated that the dip shall, while gas is evolving from the retort, remain sealed but half an inch; and, immediately upon the retort-lid being removed for drawing, the pressure is entirely removed from the dip-holder, and the self-acting dip consequently descends to a given seal of, say, 2½ inches, and so remains until the retort is again charged, when the working seal—viz., *half an inch*—is resumed.

This is, of course, submitted to those who insist that to entirely abandon the seal is objectionable.

Perhaps it will be as well for us to explain why it is that we hold a half-inch seal to be insufficient on a stationary dip-pipe. In the first place, to start a works with a seal so slight, we maintain is unwise, simply because in a very short time some of the dips would be *entirely* out of the liquid, and others more deeply immersed through settlement. In the second place, the draught caused by the exhauster upon a long run of main, would nearly, if not entirely, bare some of the dips. Lastly, in the event of a back pressure, there would not be sufficient liquid to withstand it. It will therefore be seen, by what we have advanced, that the self-acting dip is entirely under control, either to be used with a minimum seal or none at all.

S. CHANDLER AND SONS.

104, *Newington Causeway, Nov.* 3, 1876.

SIR,—The President of the West of Scotland Association of Gas Managers, whilst speaking on the desirability of removing the back pressure on the retorts, did me the honour of referring to my anti-dip valves, and inquired if any member, who had them in use, could state if there was any pulsation on the gauge attached to the hydraulic main. From the amount of practical experience which I have had with these valves, I am in a position to state positively that when the valves are open there is no pulsation whatever, and a gauge on the ascension-pipe will indicate precisely the same pressure as the gauge before the purifiers. When the exhauster is in use, and the pulsation the greatest, if the valves are opened, the pulsation will at once almost entirely subside.

Although the pulsatory action may help considerably the deposit of carbon, as stated by Mr. Boyd, and endorsed by the president, yet I venture to say that it is not the sole, nor even the principal, cause, as I have proved by experience; for I have found that, with my valves in use, and the pulsatory action entirely prevented, the formation of carbon has been in exact proportion to the back pressure from the works. I am now referring to works where no exhauster is used, and managers of such works cannot be too anxious to keep down their back pressure.

The president said he would like me to furnish some information as to how I can prove that my valves produce 500 to 1000 cubic feet increase, whether it is fact or supposition. Allow me to state that it is a well-established fact, and daily demonstrated in many works of which I could furnish particulars from all parts of the kingdom.

My earnest desire is that the truthfulness of my statements be put to the utmost test, and I would most respectfully suggest that, instead of taking any one's statements, the president will do well to ascertain of his own knowledge whether these things are so or not, before the next meeting of the Association; and, to prove my willingness to facilitate investigation, I shall be happy to fix the apparatus for testing free of cost.

W. L. COPP.

Watchet, Somerset, Oct. 27, 1876.

RECOVERY OF LIGHT OIL IN THE DISTILLATION OF SHALES.

SIR,—In my note, which you did me the favour of inserting in your JOURNAL of the 3rd inst., I made two assertions.

1. I affirmed that in his paper, as reported in your issue of the 22nd of August, Mr. Young "described, as a novelty, the use of intermediate paraffin oil for the absorption and recovery of the very volatile hydrocarbons diffused through the waste shale gases." Mr. Young now says that he "made no claim of novelty for using the oil." Let those of your readers who are interested, turn to your report of the paper under notice, and judge for themselves. They will find that Mr. Young therein narrates (1) in what way he and his brother-in-law *discovered*, much to their surprise, the absorbent action of intermediate paraffin oil on the illuminating constituents of coal gas; and (2) his application of this discovery to the absorption and recovery of the very volatile hydrocarbons diffused through the waste shale gases. It is quite true that Mr. Young referred those of his audience, who desired more information, to his specification, in which he disclaims the authorship of the application of oil for absorbent purposes; but it does not appear that he had the fairness to read his specification to the meeting, and it is certainly not quoted in your report. If he had read the disclaimer, there would have been no need for my troubling you on the subject, for it would have been apparent to all that the admission in the specification demolished the claim set up in the paper. If he had told his hearers that before Mr. Cusiter and he made their experiments, intermediate oil had been introduced as an absorbing agent on a manufacturing scale, his anecdote would have fallen flat on the North British Association of Gas Managers.

2. In my note I also affirmed that intermediate and heavy paraffin oils had been employed in this work for the past nine years, for the absorption of the *very volatile* hydrocarbons present in waste shale gas. To this Mr. Young replies, that Messrs. Young's Paraffin Company have never recovered the *very volatile* hydrocarbons, while he has done so. What is plainly sought to be conveyed by this assertion is, that Mr. Young has recovered, by the agency of intermediate oil, *more volatile* hydrocarbons than have been recovered elsewhere by the same agency; in short, that he has applied the oil more successfully than others. It will be noticed that, if this were true, it would amount to a very different claim from that made in his paper, where he poses as a discoverer and inventor, and not as an improver. But I do not admit the accuracy of his amended claim, for the more volatile hydrocarbons have all along been recovered together with the less volatile, although they have not until recently been sold separately.

Mr. Young appears to be annoyed that I should have challenged the accuracy of his statements in regard to the use of intermediate oil, without at the same time having referred to Mr. Coleman's more recent recovery method, and he accuses me of acting unfairly to that gentleman by withholding the reference. But if this charge has any force against me, who simply undertook to correct a public speaker in a matter concerning which I was personally cognizant, what must be the verdict upon one who volunteers to do himself the honour of enlightening the North British Association of Gas Managers on the general subject of the utilization of waste shale gases? Did justice not demand that he should acquaint his readers with what had been done elsewhere before Mr. Cusiter and he made their surprising discovery? And was he not under a similar obligation to make known the nature of Mr. Coleman's recovery method, which he now admits to be so beautiful? And was it not unfair to Mr. Coleman to fail to point out that that gentleman's apparatus bore a wonderful resemblance to that described in the second part of his specification, and that Mr. Coleman's preceded his own by nearly a year? But as Mr. Coleman has already taken measures to defend his invention against Mr. Young, there is no call for further remark from me.

JOHN CALDERWOOD.

Addiewell Works, West Calder, Oct. 27, 1876.

SIMULTANEOUS CLOCK AND METER ACTION.

SIR,—In answer to Mr. Warner's reply, I beg to say that I have not a cock on the inlet of the meter, and that the simultaneous action of stopping and starting is produced by the opening and closing of the bye-pass cock only. And as there is only *one* cock in the field, there cannot possibly be a cock-fight.

G. GOLDSMITH.

Leicester, Nov. 2, 1876.

BALSALL HEATH GAS SUPPLY.—At the meeting of the local board on Wednesday last, it was resolved—"That the necessary notices be given to the Corporation of Birmingham of the intention of this board to purchase the gas-mains in this district, with the view of making their own gas at a future time."

SALE OF NEW RIVER COMPANY'S SHARES.—On Wednesday last, at the Auction Mart, some shares in the New River Company were put up for sale. One-thirtieth of a king's original share was first submitted, and, after a spirited competition, realized £3135, or at the rate of £94,050 for an entire share. The special feature of these shares is that they are a freehold property, and even a a fractional part confers votes for the counties in which the company's estates are situated. Twenty-nine of the £100 new shares (£70 paid) were next offered, and were all sold at £310 and £315 per share. These are the highest prices ever reached, and a considerable increase on those obtained at the sale in June last, when the king's shares realized at the rate of £88,000 per share, and the new shares, with £60 paid, fetched £235 to £295. At the early part of this century a king's share was sold for £7000; and even in 1870, the price was £42,360, which was at the time thought to be remarkably high.

Legal Intelligence.

LEEDS COUNTY COURT.—Wednesday, Oct. 18.

(*Before Serjeant* Tindal Atkinson, *Judge.*)

Action against a gas company for personal injuries sustained by a workman.

Thomas Hulett, formerly in the employment of the Pudsey Gas Company as a stoker, sued the company for £75 as damages for personal injuries sustained by him owing to the fall of the roof of their retort-house.

Mr. West appeared for the plaintiff, and Mr. Gane for the defendants.

The evidence in support of the case was that the plaintiff, who had formerly been a stoker at the defendants works, re-entered their service in December last, and, on the 4th of January following, he went to work about six o'clock in the evening. Shortly after the night-shift was at work, the roof of the retort-house fell, and the plaintiff and a man named White were severely injured, the former the more seriously. The roof partially rested upon him for some time, and he was pulled out insensible from among burning cinders. He was taken to a neighbouring house, attended by the company's surgeon, and afterwards removed to his own home. It was nearly two months before he was able to go out again, and during the greater part of that time he was attended by the company's doctor. It was not until the 24th of June that he was certified as being able for work, and the claim for damages included the extra cost of living; the loss of wages, 30s. a week for 14 weeks, and 15s. a week from the 11th of April to the 24th of June, during which time he was gradually recovering, but unable to do the heavy work of stoking. His wife, who had before the accident been employed in a mill, and received 9s. 8d. a week, was compelled, owing to his illness, to remain at home, and the claim included the amount of wages thus lost. This amounted to £40 12s. 6d. It was admitted that the defendants had paid the plaintiff wages to the amount of £17 4s. 6d., leaving £23 8s. 6d. due to him. As to the remainder of the claim, evidence was given by Mr. E. Burchell, surgeon, Leeds, who had examined the plaintiff, to the effect that his injuries were so severe that he was likely to suffer from the effects of them for a considerable time, and would be unable to do heavy work.

To prove the liability of the defendants, Mr. West called Mr. Thomas Winn, builder, who said that he had examined the defendants retort-house, and found that the two gable walls were out of the perpendicular to the extent of from 6 to 9 inches. The stress of the roof was practically upon those walls. The defendants, it was alleged, were aware of this, because on the 1st of January they placed props against the wall, which was leaning away from the building. On the 4th of January, finding that the props were not sufficient, the defendants gave orders to take down the wall from the top, intending to rebuild it. The consequence was that the roof was supported only by a few iron girders, and after the removal of the props, one of the girders broke. The plaintiff, when he began work on the evening of the 4th of January, was unaware of what had been done, and was engaged in the usual way when the roof fell.

Under those circumstances Mr. West contended that there had been negligence on the part of the defendants.

On behalf of the defendants it was shown that for a long time before the roof fell, or the alteration of the walls was commenced, the plaintiff had been told not to "crack" the retorts, as one or two of the witnesses for the plaintiff admitted had been done, as he was endangering the surroundings. He had, persisted, however, against the rules in discharging the retorts in that way, in spite of warnings and rules, and had thus brought down the roof with a "crack." There was a further question of law as to whether the manager of the works was, within the meaning of the Act, a fellow-workman with the plaintiff, in which case it was contended the defendents would not be liable.

After hearing he evidence, the learned judge reserved judgment.

Friday, Oct. 27.

His Honour gave judgment in the above case this day. He said: This is an action brought to recover damages for a serious injury inflicted upon the plaintiff, a servant in the employ of the defendants, by the fall of the roof of their gas-works, owing, it was alleged, to the negligent act of the defendants manager, who had ordered certain props to be removed, which props had been placed against an end or gable wall of the building to keep it from further giving way. After a careful review of the evidence, I find the following facts proved:—The plaintiff was employed by the defendants as a stoker, and he, with others, on the 4th of January was engaged in what is called "drawing" the retorts—that is, freeing them from any remaining gas, previous to their being charged. The usual and safe mode of doing this is by heating a piece of metal red hot, and introducing it inside the retort, as by this means the gas takes fire, and becomes gradually consumed. The other mode, which is expressly forbidden at the works, is to admit atmospheric air into the retort until the mixed air and gas become explosive, when a flame is applied to it, and it disappears with a noise and concussion more or less severe, according to the quantity of gas in the mixture. This operation is called by the workmen "cracking." On the day of the falling in of the roof—namely, the 4th of January, the plaintiff had been told by the manager to "fire" and not to "crack" the retorts. About a quarter of an hour before the fall took place, the plaintiff, contrary to his instructions, exploded two retorts, which caused a loud report, shaking the whole of the building. At this time, and for some short time previously, the end walls of the building had become 8 or 9 inches out of the perpendicular, and the defendants manager, having had his attention called to the fact, caused some props to be placed against the wall to serve as a support. A mason was employed to place the walls in their former position, and while endeavouring to do this, the manager ordered the props to be removed. The shaking of the roof, through the explosion of the gas, made the weakened wall still further give way, and produced the fall of the roof which caused the injury to the plaintiff. In the presence of these facts, and without entering into the discussion as to whether the manager, when he ordered the props to be taken away from the falling wall, was or was not acting in common employment with the plaintiff, so as to exempt from or fix the defendants with liability, I am clearly of opinion that in exploding the retorts, contrary to the express orders of his employers, the plaintiff contributed to the falling of the roof by his own negligent act, and, in fact, was guilty of contributory negligence. There must, therefore, be a nonsuit in this case, but without costs.

Reductions in the Price of Gas.—The directors of the Lowestoft Gas Company have decided upon reducing the price of gas on and after the 1st inst., from 5s. 5d. to 5s. per 1000 cubic feet. At Bilston, the company have notified a reduction at the beginning of next year, varying from 3d. per 1000 feet in the outlying districts, to 6d. per 1000 feet in the town.

Spennymoor Gas Company.—A new gasholder has just been erected at the works of this company by Messrs. Ashmore and While, of Stockton. It has been provided for the purpose of facilitating the supply of gas to the various districts acquired by the company, by the Act passed in July last. The mains are laid to West Cornforth, a distance of five miles; at the east a distance of five miles; on the west to Todmills, where the intended new railway station is to be built. Byers Green, Ferryhill, and Ferryhill station are already lighted, and it is intended to extend the mains to Coundon. The tank of the new holder is 82 feet internal diameter, and the depth 22 feet. It is erected at the south-east corner of the district, near Spennymoor station.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in October, 1876:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen. — As Nitrates, &c.	Ammonia. — Saline.	Ammonia. — Organic.	Hardness (Clarke's Scale). — Before Boiling.	Hardness (Clarke's Scale). — After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	20·40	0·084	0·135	0·000	0·008	13·8	2·4
West Middlesex	20·41	0·082	0·135	0·000	0·008	13·8	2·4
Southwark and Vauxhall	20·20	0·050	0·105	0·001	0·008	13·8	2·3
Chelsea	20·90	0·077	0·120	0·000	0·007	13·8	3·8
Lambeth	20·06	0·091	0·120	0·001	0·007	14·3	3·3
Other Companies.							
Kent	24·24	0·010	0·255	0·000	0·000	18·2	5·1
New River	19·38	0·027	0·120	0·000	0·004	14·3	3·3
East London	19·51	0·037	0·105	0·000	0·005	13·3	2·4

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, Southwark and Vauxhall.

C. Meymott Tidy, M.B.

HYTHE AND SANDGATE GAS-WORKS.

Thursday, Oct. 26, was an important day in the history of the Hythe and Sandgate Gas Company, inasmuch as it witnessed the laying of the stone to commemorate the erection of the new and important works to the westward of Hythe, which will shortly supersede the old places of manufacture and storeage. It must be taken as a sign that Hythe and Sandgate are progressing, that the consumption of gas in both towns has lately increased at an unprecedented rate; in fact, no less than 700,000 cubic feet additional were required last year than the year before. The present works, it was evident, would soon be inadequate to the supply, and the directors found it necessary to obtain authority to raise fresh capital for the purpose of erecting additional works. Fortunately one of the estates involved in the protracted Chancery suit of *Hythe v. East* came into the market about this time, and, as it was well suited for their purpose, the directors acquired it, with three large houses erected upon it.

The land in question is nearly six acres in extent, and is somewhat more than half a mile from the Parade. The engineer consulted by the directors was Mr. Alfred Williams, of Bankside, Southwark, and he has designed for them admirable modern works, which will involve an outlay altogether of about £13,000. When these are completed, the old works at Hythe, as well as at Seabrook, will be done away with, although the storeage power at each place will be retained for the present. The new works are designed on a large scale, as the following particulars will show.

The dimensions of the retort-house are 61 feet from north to south, and 40 feet from east to west, with an elevation of 20 feet. The retort-benches comprise one bed of five, one bed of six, and four beds of seven. Clay retorts will be used, 10 feet long. The coal-store is the same size as the retort-house, and is capable of holding about 1000 tons of coal. The roofs of all the buildings are of iron. The tank, which is annular, is unique in this part of Kent. It is 72 feet in diameter and 20 feet deep. The ordinary way of constructing a gas-holder-tank is to build a brick wall, properly puddled outside, the interior excavated and filled with water. Here, in order to save the enormous expense of excavating the beach, there is simply a ring of 2 feet 6 inches width to be filled with water, the interior of the circle retaining the beach. The holder is 70 feet diameter and 20 feet deep. Both the gasholder and the annular tank are of wrought iron, and the former will hold upwards of 76,000 feet of gas. The tank was lowered into a bed of boiling tar to protect it from rust. There are ten cast-iron columns to the gasholder, and wrought-iron girders at the top. The other buildings include a boiler and engine-house, purifying-house, smithy, and meter-house, all arranged to allow for large extensions. There will also be manager's residence and cottages for workmen. The material of these buildings is Kentish rag, with brick quoins.

The works, as before stated, are designed by Mr. Williams, of Southwark; the Horseley Company, Limited, of Tipton, Staffordshire, are the contractors for the construction of the tank and holder, and supply all the necessary iron-work for roofs, purifiers, condensers, scrubber, &c.; the pipes for street-mains are supplied by the Birtley Iron Company; and the buildings are being carried out by Mr. Amos, of Hythe. Messrs. Andrews and Son, surveyors, Hythe and Folkestone, act as clerks of works. We should add that ample room has been left in every branch of the works for enormous extension, as may be required.

On Thursday, the 26th of October, the multitude of poles around the works were decorated with flags, and by three o'clock quite a numerous company had assembled to see the stone placed in position. Among those present were J. B. Andrews, Esq., chairman of the directors; Messrs. J. Nelson, Cobb, and Bull, directors; Mr. Sidle, the secretary; Mr. A. Williams, the engineer; Mr. Muntz, the representative of the Horseley Company, and Mr. Berridge, surveyor for Mr. Williams. A platform was erected on the north side of the main building for the ceremony of the day, and the company having assembled there, Mr. Andrews, the chairman, assisted by the engineer and contractor, performed the task of laying the stone in the usual fashion, spreading the mortar with an ornamental trowel, giving the three orthodox taps with a polished oaken mallet, and then declaring the stone well and truly laid.

In a recess under the stone were placed newspapers of the day and coins of the date. Inscribed on the stone were the names of the directors, secretary, and engineer, and the date. After a cheer for the Queen, three hearty cheers were given for Mr. Andrews, the chairman, who, in acknowledging the demonstration, expressed a hope that the ceremony of the day was but the inauguration of a very successful *finale*.

Mr. Nelson, on behalf of his co-directors, thanked the chairman for his attendance, and, in the course of a few remarks, observed that, although the career of the company had not been all success, yet for the last ten years they had been increasing in prosperity; and, with the help of Mr. Williams, they would shortly have large and admirable works, and be able to satisfy the good people of Hythe and Sandgate with the quality of the gas the company supplied to them.

Champagne was then brought forward, and the chairman gave "Success to the undertaking, and prosperity to the workmen and all concerned in the works." The pledge was drunk by the rest of the company on the platform.

The workmen were treated to a liberal supply of good ale, and the company present, by the courtesy of the directors, partook of refreshments in the temporary office of the works.

MELBOURNE (AUSTRALIA) GAS COMPANY.

The Twenty-Sixth Annual Meeting of the Shareholders of this Company was held at the Offices, Collins Street West, on Friday, July 21—Mr. T. MOUBRAY, chairman of the board of directors, presiding.

The SECRETARY (Mr. J. Scott) read the report of the directors, which was as follows:—

The directors herewith submit statements of accounts for the half year ending June 30, 1876, duly certified by your auditors.

The profit for the half year is £7312 4s. 3d. which, added to the unappropriated balance of £2037 10s. 7d., makes a total to credit of profit and loss of £9349 14s. 10d. From this amount a dividend at the rate of 6 per cent. per annum is now declared, which will absorb £7500, and leave to carry forward £1849 14s. 10d.

Your directors avail themselves of this opportunity to offer a few observations on recent comments of the press favouring the principle that gas undertakings should be under municipal management.

It will be in the recollection of the proprietors that the City Council of Melbourne was last year reminded of its power of purchase of the property of this company, which, after consideration, it declined to exercise. At the present time an agitation is being promoted by some members of suburban districts, with the view to the construction of gas-works for the supply of those districts, and it is urged by them that the consumer will be largely benefited by reduction in price under municipal management.

Without presuming to offer any opinion on this view of the subject, it is undeniable that recent legislation and public opinion in the mother country favours the acquisition of gas property by municipal bodies, or, failing that, amalgamation of interests, to secure economy of production. It is obvious to all acquainted with the subject, that competition in gas supply does not tend to the ultimate advantage of the consumer, and it will be immaterial whether that competition is fostered by municipal or private funds, as the result will be the same.

When it is remembered that already upwards of half a million sterling has been expended in gas undertakings in Melbourne and its suburbs, with the sanction and authority of several Acts of Parliament, common justice demands that reasonable consideration should be given to existing interests; and this, it is suggested, can only be adequately met by so important a subject as gas supply being taken in hand by Government, with a view to an exhaustive examination of the whole question, preparatory to taking decisive measures thereon.

To promote, however, a better understanding between the gas consumer and the manufacturer, an interim Act should be passed providing for the appointment of an impartial tribunal, to determine all questions affecting the quality of gas—its purity and illuminating power—with power also to adjudicate in cases where the accuracy of the registration of the meter might be called in question.

Measures are being taken to provide for a better supply of gas in localities requiring it, and as far as possible applications for extension and reticulation will be attended to. The works throughout are in a thorough state of efficiency, and strict economy continues to be observed.

Dr. Profit and Loss, for the Half Year ending June 30, 1876. Cr.

Coal carbonized			£22,072	6	9		
Coal used for fuel			23	10	6		
Cost of purifying			893	17	4		
General charges—							
Directors allowance			300	0	0		
Auditors fees			21	0	0		
Salaries			1,865	0	0		
Management of works, inspectors and timekeeper's wages			999	14	4		
Stokers & labourers wages			4,079	3	9		
Lamplighters, &c.			1,549	4	3		
Rent and taxes			661	17	6		
Subscriptions & donations			39	8	0		
Law expenses			41	3	0		
Cartage			406	10	3		
Water at works, and sundries			511	19	10		
Stationery, printing, and advertising			273	9	8		
Bad and doubtful debts			904	18	8		
Fines, overcharges, &c.			75	18	0		
Material used—							
Oil, engine packing, &c.			69	8	5		
Coal and coke sacks			66	5	0		
Wear and tear account			5,000	0	0		
Meter replacement account			500	0	0		
Service laying			912	2	8		
Interest on debentures for half year			750	0	0		
Insurance account			250	0	0		
Balance			7,312	4	3		
			£49,581	2	2		
Balance at credit of profit and loss, Dec. 31, 1875						£9,537	10 7
Amount to pay dividend to Dec. 31, 1875						7,500	0 0
						£2,037	10 7
Balance, as above, brought down						7,312	4 3
						£9,340	14 10
Gas-rates						£40,510	15 3
Residual products—							
Coke	£5228	8 4					
Tar, &c.	1643	0 8					
			6,871	9	0		
Commercial Bank of Australasia, Dec. 31, 1875			5,023	6	5		
Cash on hand, Dec. 31, 1875			85	13	9		
			£52,491	4	5		

Receipts and Expenditure.

Land, buildings, & apparatus						£2,623	4 4
Stationery, printing, and advertising						334	18 8
General charges						10,658	1 4
Repairs						1,524	6 3
Coal purchased						20,382	2 11
Lime purchased						812	3 8
Dividends to shareholders						7,433	10 0
Interest on debentures						750	0 0
Commercial Bank of Australasia, June 30, 1876						7,568	2 1
Cash on hand, June 30, 1876						404	15 2
						£52,491	4 5

General Balance-Sheet.

Capital account			£250,000	0	0		
Debentures			30,000	0	0		
Debenture redemption accnt.			22,073	15	5		
Interest on debentures			750	0	0		
Insurance account			3,755	3	9		
Meter replacement account			4,000	0	0		
Bills payable			1,316	14	6		
Unclaimed dividend-fund			565	19	4		
Sundry sums due by the company			5,505	2	11		
Wear and tear account			17,942	9	8		
Profit and loss account			9,349	14	10		
			£345,258	0	5		
Land, buildings, and apparatus						£288,672	15 0
Apparatus in store						7,156	18 8
Gas-meters						18,520	8 7
Coal account						4,818	3 4
Coke in store						56	5 0
Gas-rates due to the company						16,582	16 1
Sundry sums due to the company						1,470	16 6
Commercial Bank of Australasia, June 30, 1876						7,568	2 1
Cash on hand, June 30, 1876						404	15 2
						£345,258	0 5

The CHAIRMAN moved the adoption of the report and financial statements, and, in doing so, said the directors looked upon the balance-sheet as moderately satisfactory, taking the whole of the circumstances into consideration. It was very well known to the shareholders that the directors had been called upon to meet competition, that they had made preparations to meet it, and that they were meeting it. The interest at stake in the company—viz., £300,000 of the shareholders money, which had been invested in the company, was too large and too important to allow the business to be taken away from them without an effort being made to retain it, and he was very happy to say they were retaining it. The statements just read would show that, notwithstanding the low price charged for gas, it was surprising how well the company were keeping up. With regard to the work that had been done during the past half year, he could state that every shilling had been spent in permanent improvements, such as raising the ground of the company, and causing the buildings to be much more conveniently and economically worked. At the present time, they had covered storeage room for 4000 tons of coal, and had that quantity under cover. The retort-houses were in first-class order, and the works were never in a better position than now. They had received complaints, from time to time, from consumers south of the Yarra, that the supply of gas had not been sufficient, and, indeed, they were obliged to admit that the growth of their business south of the Yarra had got somewhat beyond their powers—*i.e.*, their improvements and appliances had not gone on increasing sufficiently to meet the increased demand. They were now, however, taking means to meet the requirement, and had purchased a piece of ground near the junction, on which they proposed to place a gasholder, which they already had in their possession, and which, when re-erected, would enable them to meet the increasing demand south of the Yarra, as they could fill it from the works in the daytime with an ample supply of gas for all the residents of Prahran and South Yarra. He thought he might say, with great justice, on behalf of all those persons who had, on the strength of Acts of Parliament, invested their money in gas companies—and in theirs particularly, which was the premier, and leading, and oldest company, and which had been, to a great extent, the teacher of people engaged in the manufacture of gas—that it was almost scandalous to see that the Legislature had so far forgotten its functions as to allow so many gas-mains to be laid, burying capital, where one main would have been more than ample to supply the requirements now being met by three. All that capital need not have been wasted, and, if proper arrangements had been made by the Legislature, it would have enabled gas to be sold cheaper. The want of such arrangements led now to competition, which would only end most unsatisfactorily, both to the public and shareholders in gas companies. However, the interests the shareholders in this company had at stake were too large to allow their business to be trifled with, and the directors were determined to meet the opposition in every possible way.

Mr. M. BENJAMIN seconded the motion.

Mr. R. SCHLESINGER was sorry to see the chairman still using the defiant tone that had been used about other persons for some years past—a tone that had reduced the price of shares from £5 12s. to £3 15s. each. He thought it would be better if the directors were to try and see the other persons, and make some arrangement with them. He did not hold a share in either the Collingwood or South Melbourne Gas Company, and his only desire was to see the Melbourne Company protected. If the same course had been applied to the gas companies as was applied by banks towards each other, it would have resulted in benefit to all parties. If the directors of the gas companies met each other as the directors of banks did about rates, he believed that a uniform price for gas could be agreed upon. Other gas companies, he thought, had as much right to put down mains as the Melbourne Company had. He did not think they should try to crush their competitors, and he was sure they never would do so. The same policy as the directors were pursuing now to the South Melbourne Company was pursued towards the Collingwood Company when they started, and all knew how that had resulted. Could not the chairman say if a meeting of directors of companies such as he had suggested could not be arranged?

Mr. MILLER thought a great saving might be effected in the lighting of the lamps, which now cost £3000. He did not think the economical view was generally appreciated by the directors as it should be.

The CHAIRMAN replied that they had now adopted the lighting of their own lamps, and the consequence was they were subjected to less fines than before. The greatest economy was exercised in all ways in the management of the company, and if the shareholders did not think so they could alter their directors, as half of them retired every six months.

Mr. R. SCHLESINGER, as the chairman had made no reply to his question, moved the following amendment:—"That the directors be respectfully requested to place themselves in communication with the directors of the other companies, with the view of ascertaining whether a uniform rate could not be charged for gas."

The CHAIRMAN said the directors had a definite policy, and that policy they had determined on, and made up their minds to carry out. There was no analogy whatever between banks and gas companies. A gas company had their capital buried underground, and could not pick it up and walk off with it to another district, as a bank could do with their money and notes. The directors had given the matter their fullest consideration for years past, and they had come to what they considered a wise conclusion. Of course, if the shareholders did not think the directors had done right, and had forfeited their confidence, they would readily give place to others whom the shareholders might elect. Whatever portion of their business they might give up, they would be giving up so much of their capital as had been spent on that portion, and no one could shut his eyes to the fact that three gas-mains lying together in a district was utter waste.

There was no seconder to the amendment, and the motion was carried unanimously.

Mr. T. Moubray and Mr. A. Sutherland, retiring directors, were then re-elected; and Mr. G. Meares was elected a director in the place of Mr. F. Poolman, resigned, the chairman having previously stated that a letter had been received from Mr. Henry Ghinn, a candidate for the directory, intimating that he withdrew from the contest, as he was going to reside in the country for some time.

Mr. R. Cohen and H. N. Hull were re-elected auditors.

The CHAIRMAN, in closing the meeting, said the directors had managed to get the company through difficulties before, and he hoped they would get them through the present ones, and that they would all meet in friendly contact next half year.

The *Prahran Telegraph* of Sept. 2 reports that at a meeting of the Prahran Municipal Council on the 28th of August, a letter was read from the secretary to the Melbourne Gas Company, for the directors, referring to recent proceedings in the council relative to a proposition for the establishment of municipal gas-works for the supply of Prahran and St. Kilda. He reminded the council that for upwards of 18 years the company had supplied gas within a large area of Prahran and St. Kilda, having been induced thereto by a requisition of the inhabitants, although at the time the sparse population afforded no immediate prospect of any adequate return for the large expenditure incurred. That the large capital of the company, provided by widows, orphans, and others, on the faith of several Acts of the Legislature, had been dedicated to its legitimate purposes with the strictest economy, by gentlemen of great commercial experience, under the management of efficient officers. That the establishment, as proposed, of municipal gas-works, while certain to prove damaging to the company, would also inevitably prove detrimental to the true interests of the ratepayers, for the reason that a large amount of capital would thereby be misapplied, the principal and interest falling to be paid by house and land owners. On the subject of expediency or otherwise of the control of gas-works by municipal bodies in contradistinction to management by public companies, it was not deemed necessary at this time to comment further than to observe that, whenever by common consent such a change was desired, and when the company's property as a whole should be sought, every reasonable facility to that end would be given by the directors of the company. It was, however, only right to remark that probably the community was scarcely yet ripe for so sweeping a change, involving, as it would, a very large outlay of municipal funds, and requiring legislation far in advance of the present. It was now regarded as a fixed principle, that municipal bodies

were entitled to be supplied with gas at the lowest current rate ruling in the respective districts. This being conceded, all that was now necessary in determining the price per lamp per annum was to fix the quantity of gas required, adding the actual cost of lighting, extinguishing, and repairs, and the difficulty was solved. In July last the price of gas was reduced to 7s. 6d. per 1000, and any alteration in that figure would certainly not be an increase unless the price of coal considerably advanced, which was improbable. With respect to the charge made against the company of not providing a sufficient supply of gas, it was doubtless true that in some portions of the district the supply had not been satisfactory, and this resulted from the spread of population and consequent increase of consumption. To remedy this, steps were now being taken to construct an outstation gasholder, which would effectually meet all requirements for years to come. The directors thoroughly appreciated the advantage and necessity of making timely provision, not only for the present, but for prospective wants also, but would like it to be remembered that gas matters in the community had not of late years been considered the most eligible by either shareholders or capitalists, and as long as this state of things was suffered to exist, difficulties would occur. The directors were compelled to observe caution alike in the interests of the shareholders and consumers. It was, however, hoped that the day was not far distant when a reasonable and proper consideration would be given to so large and important a subject as gas supply. From the directors last half-yearly report, it would be seen that they were quite prepared to aid in the preparation of any measure which would have for its object the promotion of a better understanding between the consumers and the manufacturers of gas, to secure a plentiful supply of gas of good quality, and at a reasonable price, under strict regulations, administered by an impartial tribunal. The writer enclosed a schedule showing the present capital of the company, dividends declared, &c., which it was thought would prove, as far as the company were concerned, that their shareholders had certainly not reaped a rich harvest of dividends, or been at all unduly remunerated. The letter was referred to a committee of the whole council for consideration.

ABERDEEN CORPORATION GAS-WORKS.

A Meeting of the Town Council of Aberdeen was held on Wednesday, the 1st inst.—the Lord Provost presiding—when the Gas Accounts of the Corporation, for the year ending Sept. 30 last, were presented. They showed that the capital account amounts to £135,933 13s. 11d., the whole of which has been expended, with the exception of £4115 15s. 10½d. The revenue for the past year, from gas and meter rents, was £41,990 4s. 10½d.; from residuals (coke, £588 3s. 8d., and tar and ammoniacal liquor, £3018 13s. 9d.), £3606 17s. 5d.; transfer fees, £8 17s. 6d.; total, £45,605 19s. 9½d. The cost of manufacture of gas amounted to £30,146 18s. 4d.; distribution, £1346 15s. 10½d.; rents, rates, and taxes, £1210 0s. 9d.; management, £885 2s. 11½d.; discounts and bad debts, £1022 18s. 2d.; amount transferred to depreciation (including £650 to contingent-fund), £1291 3s. 8½d.; total expenditure, £35,902 19s. 9½d.; leaving a balance of net revenue to meet annuities and interest, £9703.

An estimate of the revenue and expenditure for the ensuing year was submitted, in which the revenue is put down at £46,684, which is expected to give a surplus of £609.

The committee recommended that for the year from May, 1876, to May, 1877, the Town Council should fix the rates, rents, and sums to be charged by them for gas, and for the letting of meters, as follows, viz.:—

1. The price of gas to all consumers, other than for the city public lamps, to be—

(*a.*) At the rate of 4s. 10d. per 1000 cubic feet, for the period from May to December, 1876, subject to the following discounts on such accounts as are settled not latter than Jan. 31, 1877:—

Where the annual consumption is—

65,000 and under	100,000 cubic feet, discount	2d.	per 1000 cubic feet.
100,000 „	1,000,000 „ „	3d.	„ „
1,000,000 cubic feet and upwards . . .	„	4d.	„ „

(*b.*) At the rate of 4s. 7d. per 1000 cubic feet, for the period from December, 1876, to May, 1877, subject to the following discounts on such accounts as are settled not later than June 30, 1877:—

Where the annual consumption is—

65,000 and under	100,000 cubic feet, discount	1d.	per 1000 cubic feet.
100,000 „	1,000,000 „ „	2d.	„ „
1,000,000 cubic feet and upwards . . .	„	3d.	„ „

2. The price of gas for the city public lamps to be 4s. 6d. per 1000 cubic feet, for the period from May to December, 1876, and 4s. 4d. for the period from December, 1876, to May, 1877, without any discounts.

3. The rents for meters to be at the following rates:—

Size, No. 0 . . .	1s. per annum.		Size, No. 5 . . .	10s. per annum.	
„ 1 . . .	2s.	„	„ 6 . . .	15s.	„
„ 2 . . .	3s.	„	„ 7 . . .	20s.	„
„ 3 . . .	4s.	„	„ 8 . . .	25s.	„
„ 4 . . .	5s.	„			

For less than 4000 cubic feet of gas consumed half yearly, the rent to be 1s. per annum for Nos. 0 and 1.

Baillie Donald, convener of committee, said: It will be seen that the accounts are in a very favourable position. The transactions for the year now ending compare very favourably with the transactions of the year immediately preceding. The account opened with a deficiency of about £1300, and after deducting for the contingent-fund, and for the sinking-fund, in terms of the Act of Parliament, it closed with a surplus of fully £600. The estimates for the current year have been prepared, and carefully revised, and from the probable revenue and expenditure estimated, the committee recommend a reduction in the price of gas from 4s. 10d. to 4s. 7d. per 1000. Notwithstanding the reduction, the estimated surplus will be somewhere about £600. I may mention that the price of gas is 4s. 7d. in Leith and Edinburgh and Greenock, and if the Aberdeen Gas-Works were as near the coals as these places are, the price of gas would be 6d. per 1000 feet less. The gas-works are in a most excellent condition, and will bear very favourable comparison with any works in the kingdom. During the summer several engineers of eminence have been visiting the gas-works throughout the kingdom, and several of them have declared that our gas-works are the best they have seen. Of course the committee take no credit for the state of the works; the whole credit is due to our excellent manager, Mr. Smith.

The Lord Provost: We will readily and heartily adopt the report.

Hexham Gas Company.—A correspondent of a local journal, speaking of the alterations and improvements in the works of this company, congratulates the directors, as well as the consumers in the town, on the quantity and quality of the gas now supplied. He adds: "I understand that it has been a matter of deep anxiety with the directors, for some years past, to accomplish the desideratum now happily realized; but from various causes their intentions were frustrated, until at length the improvements in the manufacture and distribution of this valuable necessary of civilization were initiated by the late manager, Mr. Hall, and have been successfully completed by the present manager, Mr. Rogers. Nor have these desirable objects been accomplished without some sacrifice on the part of the directors and shareholders, who nobly consented to forego their usual dividends for a time, in order to meet the wants of their customers; and I trust the customers will not fail to show their appreciation of so laudable a public spirit on the part of the manufacturers of their lights."

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 635.)

At the conclusion of the President's Address, a report of which appeared in our last two numbers,

Mr. W. Young (Clippens) said: The President's Inaugural Address has taken rather an unusual form, having more of the character of a paper than an Inaugural Address. In it he has dealt with and discussed various processes, and, amongst others, that with which I am connected, along with Mr. Aitken, of Falkirk. The President has also asked certain questions, which I feel it incumbent upon me to answer, before I commence to lay before you the few remarks I have to make. The first question he asks is, whether the hydrocarbons which, by our analyzing process, are put into the gas, would remain in it? He says that at present we appear to have a superabundance of hydrocarbons, from the fact that we have to pump them now and again out of our drip-boxes, and that if they were not in superabundance they would not settle out of the gas. Now, if we take a little drip-box oil (and I think members of this Association should investigate the subject for themselves), and put a small quantity in a small still or ordinary Florence flask, which may be easily obtained, and apply heat till we draw off the more volatile portions in the form of vapour, we shall find that there is left a considerable quantity of dense oily matter, which requires a high temperature to distil it; indeed, a small portion of it is so fixed that the flask will soften before it will distil. If we allow this dense oily portion to cool, and again, by any convenient means, bring it into contact with the gas, we shall find that the illuminating power of the gas is much reduced, because those oils again satisfy their solvent affinity for the lighter hydrocarbons, by robbing the gas of the naphtha vapours diffused through it. Now, in my opinion, it is simply in consequence of the bad manner in which our gases are treated during condensation that those dense oily hydrocarbons find their way into our gas, and thence settle out into our drip-boxes, carrying with them a portion of volatile hydrocarbons, which, but for the solvent action of these oils, would have remained permanently diffused through the gas. I think this is conclusively shown in works where common caking coal is used, and the condensation produced rapidly, and where the denser naphthaline vapours are so abundant as to crystallize out and choke up the pipes. I am perfectly satisfied in my own mind that the gases treated by this new mode of fractional condensation will be much more permanent than when otherwise condensed, because those gases are completely freed from the oily hydrocarbons. Our president next referred to a process which has been experimented upon by Mr. Vernon Harcourt, and in doing so he adverted to the statement made by that gentleman, that, even allowing that all the volatile hydrocarbons diffusible through the gas, but which are ordinarily left in the tars, were diffused through the gas, the results would be comparatively trifling. Well, I have frequently tested the amount of increase in illuminating power resulting from the diffusion of the vapours of naphthas through gases, and might give you the results of these tests; but I prefer giving you the results as ascertained by the late Dr. Letheby, who, in making experiments in this connexion for the Corporation of London, found that a grain of ordinary naphtha vapour added to a cubic foot of 12-candle gas increased its illuminating power from 5 to 10 per cent., dependent on the proportion of carbon in its constitution. Now, Mr. Harcourt says there is only about a quarter of a gallon of naphtha in the tars per 10,000 cubic feet of gas made, and that this quantity would add 1¾ grain per cubic foot. If, then, one grain adds from 5 to 10 per cent, 1¾ grain, we might calculate with all safety, would yield 10 per cent., more particularly of the naphthas of English caking coals, which contain a high per centage of carbon in their constitution. Now, if English companies could add 10 per cent. to the illuminating power of their gas, it would, in my estimation, be a great gain. I think it is possible to add this 10 per cent., and further, I think that, by proper condensation, they would not only improve the illuminating power, but they would not be troubled in the slightest degree with solid naphthaline or other deposits in their mains, which at present give them great annoyance during cold weather. The process adopted by Mr. Vernon Harcourt to condense or slowly cool the gas was a very beautiful and ingenious one; but, with all deference to his great judgment and scientific knowledge, and to the great practical experience of Mr. Livesey, who, if I remember rightly, assisted him, I think that process had certain defects. In the first place, experiment has taught me that unless the tars, whilst in the presence of the gas, are kept at a high temperature, they are not prevented from absorbing and retaining a portion of the naphtha vapours; unless the crude gases were very highly heated on entering the condensing arrangement, or the tars and gases were artificially kept hot, there is no doubt but the naphthas would be more or less absorbed; indeed, such must evidently have been the case, as the effect upon the illuminating power of the gas was *nil;* for I think it is an undisputed fact that the gas could take up and retain the naphtha, were it presented to it in an isolated form. In the second place, in order that the crude gas be properly treated during condensation, it is absolutely necessary that the process of cooling be not only slow, but that the gas be analyzed or subjected to a species of fractional condensation. This and other matters referred to in our President's Address will be more fully explained in the subject which I have chosen for my remarks to you to-day—viz., that of

CONDENSATION.

I think we are far too apt to look upon the process as a simple cooling of the gases, and to overlook the important fact that the nature of the resulting products—gas, tar, and ammoniacal liquor—very much depends upon the manner in which this cooling is produced. In short, I am of opinion that we have hitherto given this very essential part of the manufacture of gas far too little careful study.

The products of the destructive distillation of coal, as you are aware, depend considerably upon the temperature at which the coal is carbonized or distilled. If the temperature be very low, the quantity of permanently gaseous matter is small, the hydrocarbonaceous portion appearing, by reflected light, as a dark greenish-looking oil; and, when held between the observer and the light, in a thin film, and thus viewed by transmitted light, it is of a dark claret colour. On the other hand, should the temperature employed be high, then the gaseous portion of the distillate is greater in volume, and the liquid hydrocarbonaceous portion is darker in colour, being quite black, and syrupy in consistence, or what we style our *tar;* and, in the many attempts which have been made to convert a portion of those tars into permanent gas by employing a very high temperature to decompose them, the more gaseous hydrocarbon portion deposits as sooty pitch.

I have here a diagram giving the names, rational *formulæ*, and boiling points of the crude products of the distillation of coal, at temperatures such as you are using every day in your works. You will observe that the permanently gaseous products suitable for the formation of illuminating gas come first, followed by the volatile hydrocarbons, which are more or less diffusible through those permanent gases, and thereby impart to them more or less illuminating power; these are, in turn, followed by the denser hydrocarbons, having high boiling points, and by the acid and alkaline hydrocarbons and solid carbon, or soot, all of which it is desirable to remove in the tars. Finally, we have the gaseous impurities to be removed by scrubbing and purifying.

We have thus indicated how it is most desirable to arrange the products of the distillation of coal when the manufacture of illuminating gas is the object aimed at. The question next arises, how may this be most easily and perfectly accomplished? A careful study and investigation of the various affinities existing between the different products, and the physical laws affecting the diffusion of gases, and the vapours of hydrocarbon fluids through them, will suggest the best means of accomplishing what we desire.

If we take some of our ordinary tar, and subject it to a slowly increasing temperature in a still, we shall find that there is first liberated sulphuretted hydrogen,

marsh gas, with various other homologues of the marsh gas type; also, olefiant gas, propylene, tetrylene, &c., which are permanently gaseous at ordinary temperatures. We next get various volatile hydrocarbons of the olefiant, benzine, and paraffin families of compounds. These are in turn followed by the denser hydrocarbons, having comparatively high boiling points, accompanied by the various acid and alkaline hydrocarbons, the finely divided carbon and soot being left in the still.

If we now take a little of the volatile hydrocarbon derived from the early part of the distillation of the tar, and bring it into contact with the gas, from which it was originally condensed, we shall find that it is rapidly volatilized and diffused through the gas. Now, since we thus see that these volatile hydrocarbons are so readily diffusible through the gas, the question suggests itself, why were they not left diffused in it during the process of manufacture? Simply because the heavy hydrocarbons simultaneously produced absorbed and removed them, just as we have seen the permanent gases absorbed and dissolved.

I have here a test-tube, the bulb of which is filled with gas, and the stem with water. I will now introduce a little of this volatile hydrocarbon derived from the early stages of the distillation of the tar. You see how it becomes diffused through the gas when I bring them into contact by shaking the tube, and how, at the same time, the water is displaced. But if I now take a little of the dead oil, which belongs to the last of the distillate, and introduce it into the tube, you see that it has the property of absorbing the vapours of the volatile hydrocarbons diffused through the gas. If I now slightly heat the denser oil by holding the bulb of the tube over the flame, the absorbed hydrocarbons are again volatilized, and become diffused through the gas. Thus we see, on the one hand, the diffusive action of the gases, or, in other words, the tendency of the more volatile hydrocarbons to diffuse through the gases; and, on the other hand, we have the affinity between, or solvent action of the denser hydrocarbons for the more volatile tending to prevent this diffusive action; and, again, we have heat neutralizing the absorbent action of the dense hydrocarbons.

Now, the amount of volatile hydrocarbons left in the gases, and, consequently, their illuminating powers, depend entirely upon how far we allow the one or the other of these influences to preponderate. By allowing full play to the diffusive action of the gases during the process of cooling, and by restraining or preventing the solvent action of the heavier hydrocarbons or tars, the illuminating power of the gas will be very much increased; and, by doing the reverse, the gases will be very considerably reduced in quality.

This leads us now to consider how those respective forces may be most conveniently controlled, in order to bring about the results we desire. We have seen that by heating the tars they give off the vapours of the volatile hydrocarbons, or, in other words, the affinity between them is overcome by the heat, and the volatile portions distilled over. The diffusive action of the gases is also increased by raising the temperature. I think that these effects point conclusively to the fact that the tars and gases, during the process of condensation, should be cooled *slowly*, and that the tars, so long as they remain in the presence of the gases, should be kept *hot*.

In the oil-work with which I am connected, we, by the systematic application of the affinity just referred to, successfully remove nearly every trace of hydrocarbons from our gases. We allow the oils and gases to cool together, thereby enabling the denser oils to saturate themselves with the very volatile hydrocarbons. These saturated oils, are then distilled, the lighter being thus separated, and the heavier being again returned and passed through an arrangement resembling the ordinary scrubber, where they again absorb from the waste gases which are passing up through the scrubber a further quantity of the vapours of the hydrocarbons. These are again in turn distilled from the heavy oils, which are again cooled, and again sent through the absorber or scrubber. This process is continually repeated; and the results are, that we are recovering from our waste gases about 3000 gallons weekly of a volatile fluid such as I have in this bottle, and which represents about 80 per cent. of the total illuminating power of the gases from which it is taken.

I am satisfied that by applying your tars to the gases which you are making, you would in a similar manner remove nearly the whole of the hydrocarbon vapours diffused through them; and in works where the present system of condensation allows the tars and gases to cool together, there is no doubt that the tars act in the manner indicated, and remove from the gases naphtha vapours which should have been sent to the customers. Members may readily satisfy themselves in this respect; for they have only to procure a piece of pitch, pound it to powder, and place it in an arrangement similar to a small purifier; through this pass a current of gas, and it will be found that after some time this pitch is no longer pitch, but has softened into a pasty liquid. This has resulted by its absorbing from the gas the vapours of the naphthas suspended through it.

Or, instead of the pitch, heat the ordinary tar till the whole of the naphtha has been driven out in the form of vapour. Spread this hot denuded tar over the surface of sawdust, and charge a small purifier with the whole. The photometer will show the great loss in illuminating power which the gas has sustained from coming into contact with these tars. In America, where they sometimes use wooden pipes for transporting the gas, attempts have been made to render those pipes perfectly impervious to the gas by coating them with pitch; but it has invariably been found that the pitch soon softens, and runs down to the lower side of the pipe, because the pitch in this case satisfies its affinity for the more volatile hydrocarbons by robbing the gas which is passing in contact with it.

All these facts point out the desirability of removing the tars proper from the crude gases as rapidly as possible. By the time the gases reach the hydraulic main, they have so far cooled that the greater portion of the tars becomes condensed; but they are in such a finely-divided state, that they continue to float forward along with the gases. Cooling has now very little effect upon them; in fact, rather the reverse, for in winter, during rigorous weather, the tar nuisance is always most troublesome, even finding its way into the purifier, and more or less preventing the proper action of the lime. Washing with ammoniacal water does not remove it to any great extent, and if we employ a chest, filled with some porous substance, such as breeze or whin-twigs, the pores soon become closed, and impede the flow of the gas, necessitating frequent changes.

Now, as I have already said, I think that in order to arrive at a method of attaining our ends by means of proper mechanical appliances, we have only carefully to investigate the chemical affinity and physical condition of the substances with which we have to deal. I have here a quantity of finely divided carbon, combined with denser hydrocarbons, or, in other words, soot, which I will take as representing the finely divided tar particles in the gas. I have here also a jar containing water, to which I add a little of the soot. Do as I like, stir my utmost, I find it impossible to wet the soot. It keeps floating on the surface, flowing off as water does from a duck's back. Now, I have here another jar containing naphtha, to which I will add some of the soot. You see how the whole is at once wetted, the affinity of the soot for the naphtha causing them immediately to commingle.

Here, then, is conclusive evidence that water is of no avail whatever to wash out sooty, tarry matter from the gas, but that, on the other hand, naphtha is a material excellently adapted for that purpose, and that we have only to bring them together, when the one will join the other. This we may practically accomplish in a variety of ways in the manufacture of gas, either by volatilizing the naphthas into the crude gases, when the naphtha vapours will at once attach themselves to the sooty tar particles, causing them to settle out; or by causing the crude gases to flow through narrow orifices, which are being constantly wetted with the naphthas or other lighter hydrocarbons flowing over them. I think this experiment also explains the difficulty experienced where very high heats are employed to obtain a large volume of gas, by decomposing the tars, and where the various parts of the apparatus get choked up with sooty pitch, the reason being that it is essential that liquid tars or some other hydrocarbons be present to combine with and remove the sooty pitch from the crude gases.

If we pass ordinary coal gas through benzine or other very volatile hydrocarbons, the gas will take up a portion of the benzine or other hydrocarbon vapour, and deposit matter which will change the benzine to a dark claret colour. If all the benzine be now distilled off, there will remain behind a small quantity of tar. Now, I do not think that properly manufactured gas should contain this tar, which I believe is the result of the gas not being properly treated during condensation.

We all know that, in order to procure naphtha free from the denser hydrocarbons, it is absolutely necessary to subject it to a series of distillations, either by repeatedly distilling and fractionating the earlier from the later portions of the distillation; or by employing an arrangement by which the vapours, as they pass from the still to the refrigerator, are subjected to repeated washing by the more easily condensed portion of the distillation, such as is effected by the "Coffey" still; and I am of opinion that, unless our crude gases are similarly treated, they will invariably retain, suspended through them, a greater or less quantity of tar.

I have here a series of three Woolf bottles. No. 1 is charged with a very volatile hydrocarbon fluid from the early stage of the distillation of tar; No. 2, with a less volatile portion of the distillate; and, No. 3, with dead oil, or the last of the distillate. I will now pass a little of the gas supplied to this room through the arrangement, entering by No. 3, and being drawn off at No. 1, from the light naphtha. You see how remarkably the gas has been charged with the naphtha vapours. I will now reverse the current, passing the gas first into No. 1, and out from the dead oil in No. 3. You now see that the gas is no longer charged with the vapours, but is considerably worse than on entering the Woolf's bottle arrangement, the reason being that the vapour taken up by the gas from the first bottle is partly absorbed by the second, and, to all intents and purposes, entirely removed by the third, along with some of the hydrocarbons in the original gas. This clearly shows that our gases should leave the cooling or fractional-condensing arrangement only in the presence of the lighter naphtha vapours; or, in other words, the tar should be made to flow *against* the current of crude gases entering the condensers or coolers.

If from time to time we test our gases as they pass through our manufacturing plant, we shall find that the quality is constantly varying. More particularly is this the case in small works, where the charges cannot be made (so to speak) to perfectly *overlap* each other; but in all works there is an appreciable difference in quality from hour to hour. Now, we all know that just in proportion to the quality of the gas we make is the proportion of naphthas in our tars, therefore whilst the condensers are condensing 30-candle gas, there will be condensed, and pass away with the tars, a considerable quantity of naphtha which could have been taken up by say the 10-candle gas produced at the end of the distillation, or at some other time. It is evident that to take full advantage of the naphtha vapours produced with the crude gases, our condensing arrangement should be such as to retain the naphthas when they are over abundant, and hold them in readiness in an isolated form, to be taken up when the gases passing are not fully saturated.

We now come to consider the gaseous impurities—ammonia, sulphuretted hydrogen, carbonic acid, &c. We have here an alkaline gas and two acid gases, which, under favourable circumstances, will unite to form salts. At first sight, when we consider the strong affinity of water for ammonia and its salts, nothing seems more simple than the removal of the ammonia, and so much of those gases as the ammonia can combine with; but, in practice, we find that what at first presented so little difficulty, is not, after all, so easily accomplished, and that other affinities come into play which make it by no means such a simple matter.

If we take a portion of ordinary ammoniacal liquor, and gradually heat it to the boiling point, we find that there is first liberated a large volume of sulphuretted hydrogen and carbonic acid, and a comparatively small quantity of gaseous ammonia; and if we cool the ammoniacal liquor, after being so heated, we find it contains free or caustic ammonia. This points conclusively to the fact, that water has a stronger affinity for the ammoniacal gas, than even the acid gases, which are liberated by the action of the heat, have for the ammonia.

In our hydraulic mains, where the temperature is frequently as high as 150° Fahr., there is condensed a considerable quantity of water; but from the very fact that it is condensed at this high temperature, it contains ammonia, principally in the caustic state, or uncombined with the gases which it is desirable to remove, or otherwise, as sulphocyanide.

To enable the ammonia, therefore, to combine with its full complement of the sulphuretted hydrogen and carbonic acid, it is essential that the water be allowed to begin to absorb the ammonia only when both are perfectly cold, as by this means the ammonia and acid gas are left in contact till (if I may be allowed the expression) they have formed gaseous salts, and are in the state best suited to be removed by cold water, by one single operation.

I have only one more experiment, and then I have done. I have here the sample of crude hydrocarbon fluid recovered from the crude gases before alluded to, with which I wish to show you how tenaciously the sulphur compounds are retained by the hydrocarbons. This sample was absorbed out of the gas by an oil free from sulphur in any form. It was distilled from this oil in an atmosphere of steam twice the volume of its own vapour, yet it has held on by the sulphur compounds. I have here a test-tube, into which I will pour a little of the recovered fluid. I will now add a little of a salt of lead, which you see is at once converted into a sulphide of that metal from the sulphur compounds contained in the hydrocarbon fluid. I think it is evident, from this experiment, that it is very desirable that the gas be perfectly cooled and freed from every trace of tarry matter or surplus hydrocarbon before being sent to the purifier, as every particle of tar or other unnecessary hydrocarbon carries forward sulphur compounds which should be left in the tars.

At our last meeting at Greenock, allusion was made to the relative values of lime and oxide of iron as purifying agents. Perhaps, although rather a digression from my subject, I may be allowed to show, by experiment, the action of these respective purifying agents upon those sulphur compounds removed from the crude gases along with the other hydrocarbons.

I have here two funnels. One is filled with moist oxide of iron, the other with lime. Through each I will filter a little of this fluid recovered from the crude gas. If I now take a little of that which has passed through the oxide of iron, and add to it a solution of a salt of lead, you see that the sulphide of that metal is still formed, showing that the oxide has not removed all the sulphur compounds decomposable by the lead salt. If I now add in a similar manner, the solution of lead to that portion which has passed through the lime, no sulphide of the metal is found, showing that lime is by far and away the most perfect purifying agent.

I will now, as briefly as possible, recapitulate the conditions which, in my opinion, are essential to the proper treatment of the crude gases during condensation or cooling. At the same time, by reference to this model of the new form of fractional condenser or analyzer, I shall show that those conditions are more or less attained.

First, then, we have shown that the tars have a solvent action for the naphtha vapours diffusible through the gas, and that to counteract or prevent this solvent action, it is necessary that the tars and gases, during and till separation is effected, should be kept in a heated state. This is accomplished in this arrangement by bringing the crude gases and suspended tarry particles in as warm a state as possible into the lower chamber of the analyzer, and there keeping

them heated by the jacketed still on the bottom, and double trays kept heated by steam.

It was also shown that, to remove the tar particles, it was essential to keep the crude gases warm, and that they travel slowly. This is also attained in the analyzer, by the free open spaces or chambers between the trays, and whereby the gases are kept heated in the manner we have indicated.

We next pointed out the desirability of having a filtering arrangement to remove the very finely divided tarry, sooty particles which were difficult to settle out, and how this could be most easily accomplished by having the filtering surface constantly wetted with naphtha or light tar oil. In this arrangement we have these tubes of fine wire-gauze hanging from the edges of the apertures in each alternate tray, through which the gases are made to pass; and as the lighter tars and naphthas condensed in the higher compartments have to flow backwards over the surface of these gauze tubes, they are thus kept wetted. This entangles the sooty particles floating in the gas, and at the same time the gauze tubes are washed clean by the flow of naphthas over their surface.

Next we showed that in order to free the tars from naphthas and the gases from tars, it was necessary that the condensing process be a fractionalizing one; that is, that the crude gases be repeatedly exposed to the washing action of the condensed but heated tars and naphthas; and that the heated tars and naphthas be in a similar manner repeatedly exposed to the diffusive action of the heated gases, and only allowed to escape from the condenser at a temperature so high as to prevent them holding on by any of the naphthas.

This arrangement effects that object by causing the condensed naphthas and tars to flow always against the current of heated gases, thus washing the gases free of denser oils and tarry particles. At the same time that the heated gases give up their denser tars, they take up the lighter naphthas condensed in the upper chambers, and flow over the fine netting tubes; this process being repeated at each chamber and wire-gauze tube, the denser naphthas taken up by the gases in the lower chambers being condensed in the upper ones, and again flow back to be again revolatilized as they meet the current of heated gases; and again, the gases, as they pass from chamber to chamber, and through the successive wire-gauze tubes, alternately give up the heavy naphthas and tars and take up lighter ones, till they are finally washed with the lightest cold naphthas flowing over the highest wire-gauze, and being thus analyzed contain only naphthas proper.

And lastly we showed that the condensing arrangement should be such as to have what we may call a fly-wheel action in equalizing the quality of the gas; or, in other words, that it should be able to fractionate or separate the naphthas when they were in superabundance in the gases, and retain them to be presented in an isolated form to the gases which might be deficient in hydrocarbons, thus keeping the gases constantly equal in quality.

You will observe that in this arrangement each of the trays is formed with a ledging, enabling it to contain a considerable quantity of the matters condensed out in the chambers above it; and as at each successive chamber the temperature of the crude gases is lower, it will be evident to you that each successive tray will contain respectively lighter tars or naphthas, and that in the upper trays, where the temperature is little over that of the air, there will only be the very lightest naphthas, and that these naphthas will be taken up by the gas when its diffusive action for vapours is not satisfied.

The report of the discussion which followed the reading of the above paper will be given in the next JOURNAL.

NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

HEALTH SECTION.

(*Conclusion of the President's Address from page* 638.)

Omitting, for want of time, many important subjects I wished to include in this address, I must not forget that we are now present in the mighty city of Liverpool, a city which has received us with marked distinction and unbounded hospitality; a city which, be it remembered, took the lead in the promotion of sanitary measures, for in the year 1842, six years before the passing of the first Public Health Act, the Corporation of Liverpool sought and obtained an Act entitled "An Act for the Promotion of the Health of the Inhabitants of the Borough of Liverpool, and the the Better Regulation of Buildings in the said Borough." This Act was, however, mainly a building Act; and in consequence of being an unavoidable compromise between the builders—a very influential body at that day—and the Town Council, was in some respects defective and inefficient. Nevertheless, great good resulted from it, for houses subsequently erected were better planned and better built than had previously been the case. It was followed by other sanitary measures of greater importance. In the year 1845 the Town Council turned their attention to the subject of water, and the inadequacy of the then supply, which was limited in the southern portion of the town to about 10 gallons per head per diem for all the purposes of domestic trade, and manufacturing consumption; and in the northern part of the town to not more than 7 gallons. These supplies, amounting in the aggregate to about 4 million gallons per day, were obtained from the new red sandstone rock, by means of wells, from which the water was, and to some extent still is, raised by steam power. At this period, also, the then existing Commissioners of Highways had just completed another work of the same character, mainly for ensuring a supply of water for the extinction of the fires occurring in the vicinity of the docks and warehouses, and in some of the other more valuable parts of the town. This work was successful enough for its purpose, and at that time yielded about 1½ million gallons per day, afterwards increased to fully 2½ millions. In the following year the corporation proceeded with inquiries having for their object the discovery of sources available for the supply of a large quantity of soft mountain water in addition to the supplies already mentioned; and after much consideration finally adopted the project known as the Rivington Pike scheme; and in 1847 the corporation brought a bill into Parliament for the construction of the Rivington works, and for the acquisition of all the water-works of the commissioners and companies; and, after an almost unexampled contest, succeeded in carrying their measure; but not without sustaining some considerable losses in water, consequent on the conditions imposed upon them during the passage of the bill through its committee stages. However, in the end, the corporation were left with an estimated total quantity of water amounting to about 20 million gallons per day, afterwards to be further reduced by the non-acquisition of some of the water they were authorized to take, and by the abandonment of some of the wells, the waters of which had become unfit for use. Subsequently a portion of the compensation water was purchased, and additional impounding reservoirs were constructed; and at the present moment the quantity of water available for the purposes of supply may, I think, be safely estimated in round numbers at about 20 million gallons per day, equivalent to the supply of about 800,000 people, with a daily quantity of 25 gallons per head, the present population actually supplied being somewhere about 660,000. The narrow margin thus left for future demands is expected to be exhausted in about eight years from the present time.

Under the able management of Mr. Deacon (borough engineer), the supply has been changed with great advantage from a restricted intermittent to an unrestricted constant system, and as a consequence of the admirable method he has devised and adopted for the discovery, suppression, and prevention of waste, the municipality have emerged, as respects the quantity of water at their disposal, from a state of actual poverty—poverty in the midst of plenty—to a condition of redundant wealth. They have now enough and to spare. Had time permitted, I should have availed myself of this opportunity to explain the method of Mr. Deacon, and the beneficial effects of his success in a sanitary point of view.

To provide a town with water of a suitable quality is now a matter of great difficulty and much expense. Competent and available sources are becoming fewer and fewer, and must in general be sought at distances always becoming more remote. Moreover, the value of land, labour, and materials is almost day by day enhancing, and so rapidly and steadily that the present cost of a reservoir is, as I know by repeated experiences, double what it was less than 30 years ago. Indeed, the present average expense of procuring and distributing a gravitation supply of one million gallons per day, obtained from a distance of only 10 miles, is rarely less than £160,000, and not very unfrequently even a larger sum. Taking into account the interest on the capital invested, the redemption-money, the repairs and maintenance, the rates and taxes, the working expenses, and the incidental disbursements, the cost of one million gallons a day thus obtained, commonly enough amounts to £12,000 a year, and hence the cost of 1000 gallons of water now amounts to nearly 9d. net, whereas, in my own bygone days, 4d. or 5d. per 1000 gallons was considered a rather extravagant charge. I place these facts before you in order that you, as sanitarians, may become aware that the popular outcry on the subject of water-charges, and against the suppression of unnecessary, reckless, and wicked waste, is wholly unwarranted, and all the more so in the case of the communities which are in the receipt of one of the greatest, although the least ostensible of blessings—viz., a constant and unlimited supply of pure water, delivered at high pressure, constituting a living spring in every man's house, available at any moment for every purpose of necessity, comfort, or convenience.

Under the now existing conditions of the water supply of Liverpool—than which no city possesses a better, and few cities a cheaper, for the average charge does not exceed 7d. per 1000 gallons—I think we may well congratulate the corporation on the complete success of this, their greatest enterprise.

Many of you have seen the Rivington works, and know their extraordinary magnitude. For those, however, who may not be able to avail themselves of the courteous invitation of the Town Council, I will briefly state a few of the most prominent particulars:—

1. The drainage-ground comprises 10,000 acres, rising to an elevation of 1500 feet.
2. The average rainfall is about 52 inches.
3. The loss by evaporation is 14 inches.
4. The reservoirs are six in number, and have a total length of nearly 6 miles; the largest reservoir being about 2½ miles long. Their united area is 615 acres.
5. The total storeage capacity is 4500 million gallons.
6. The compensation water delivered in priority to the mills and streams is 6,500,000 gallons per day.
7. The residue available for Liverpool is 13 million gallons per day.
8. The filter-beds cover about 8 acres.
9. The main-pipes are of cast iron, one of them 44 inches in diameter and 22 miles in length; and others of 36 inches diameter and 7 miles in length.
10. There are three intermediate reservoirs on the line of main-pipe between Rivington and Liverpool, besides several service reservoirs in the town.
11. And there are, by my estimation, more than 500 miles of distributory pipes for the purpose of conveying the water to the doors of the inhabitants.
12. The revenue of the corporation from the supply of water for all purposes exceeds £180,000 per annum, and realizes from rents, rates, and charges of all kinds, exclusive of receipts for supplies for trades and shipping, about 5*s.* 6d. per head of the population.

The corporation, in view of approaching demands are now again occupied with the consideration of the best source to be hereafter resorted to for an additional supply; the discussions on this important question are, however, not concluded.

I have already adverted to the increasing difficulties which present themselves when an endeavour is being made to obtain new or additional sources of water. As in the case of the Sybil's leaves, the number diminishes and the cost increases. It is, therefore, important to consider what daily quantity per head is in general necessary for the domestic purposes of an urban population, when the water is distributed on the most improved principles of constant service under high pressure; the meaning of the term "constant service" being not that the water is flowing incessantly and wastefully into the dwellings of the people, but that it is always available for their use in any required quantity by simply opening a tap placed in direct communication with the water-main; and the meaning of the term "high pressure" being, not that the water will ascend to an unlimited elevation, but in general into and above the level of the top storeys of all houses that are not situated at an exceptional elevation.

By actual and exact experiment it has been ascertained that an efficient supply to cottage houses does not require more than 10 gallons per head, whilst in the largest houses the demand rarely exceeds 20 gallons per head. Nor does the domestic service of a large town require in practice a greater quantity of water than 15 gallons per head for every needful purpose, provided only that means be taken for the prevention of reasonably avoidable waste by the use of the proper pipes and fittings usually prescribed in the regulations of all well-conducted water-works undertakings. To this quantity is then to be added as much as may be necessary for the public and trade and manufacturing purposes of the particular place to be supplied. Few towns require more than from 7 to 10 gallons for these purposes. In general, then, a competent supply for all purposes will not average more than from 22 to 25 gallons, and such may sometimes be afforded with from 15 to 20 gallons—the difference depending chiefly upon the fact of the town in question being what is termed a closeted town or a non-closeted town.

The necessity for the adoption of an uniform and uniformly applied system of rules and regulations is manifested by the results of their application or otherwise in towns of a generally similar character. Oxford and Cambridge are two such towns; in the former, where no efficient regulations are in use, the quantity delivered is 50 gallons per head; in the latter, where efficient regulations are in use, the quantity delivered is 18 gallons. Again, Glasgow and Manchester are two other such towns. In the former, no efficient regulations are in use, and the quantity delivered amounts to 52 gallons per head; whilst in the latter an admirable system of regulations is in force, and the quantity delivered amounts to only 22 gallons per head. Other very important instances are afforded by Norwich and Sheffield. The water-works of these large towns were formerly managed on the now almost exploded system of intermittent service. Acts of Parliament were, however, passed requiring the constant service system to be substituted, and in both cases the failure was complete. The daily delivery in each instance rose to 40 gallons per head, with the consequent exhaustion of the means of the undertaking. Then came the application of the regulations essential to the practice of constant supply with the speedy result of reducing the delivery at Norwich from 40 gallons to 15 gallons, and at Sheffield from 39 gallons to 18 gallons, and in both instances with other beneficial effects of no mean importance—a marked improvement in the pressure available for domestic purposes and the extinction of fire and the prevention of the damp and sloppy condition of the dwellings of the poor, which a leaky and wasteful and neglected water service always occasions. But these observations will, I fear, not seriously influence the public mind, unless I can succeed in showing how much they affect the pocket. Fortunately the task is not difficult. I have shown that a well-conditioned service requires less than half the quantity of water that is demanded by an ill-conditioned service. Now, the collection of water usually costs £60,000 per million gallons of daily supply, and its conveyance to the point at which the distribution commences will frequently cost as much more, but, by way of illustration, we will say for the two about £100,000. Assuming, then, that the careless system requires 40 gallons, when the careful system requires only 20 gallons, we have the following pecuniary results:—1. That the careless system will require an expenditure of £4 per head for collection and conveyance. 2. That the careful system will require an expenditure of only £2 per head. If we apply these results to a population of 500,000 people, we shall find that the

careless system necessitates an expenditure of £2,000,000 for purposes which can be better and more beneficially accomplished on the *careful* system, by an expenditure of £1,000,000.

Thanks to the intelligently directed energy and perseverance of the borough engineer of Liverpool, the enormous waste of water incident to the careless system has recently been so far suppressed that the Water Committee have been enabled to resume with success and advantage the constant service which the excessive waste had caused to be abandoned, but even yet no satisfactory code of rules and regulations has been adopted. I do not think I can do a greater service to the cause of sanitation than by appending an example of the code of rules and regulations now very generally adopted in well-conducted water-works undertakings successfully established on the broad principle of constant supply at high pressure.

On one apparently trivial matter, but very much, I assure you, affecting the health and comfort of the occupants of the smallest class of back-to-back houses, I will make a single remark. I do not approve of carrying the water-pipes into the one ground floor apartment of these dwellings, unless, indeed, very special arrangements be made for the prevention of damp. In the interests of health, it is much better to allow the water to be drawn from a protected stand-pipe placed in the court in which the houses are situated.

Before quitting this subject of water supply, I feel it my duty to enter a distinct protest against the views officially expressed in the reports of the Rivers Pollution Commission—views which, if correct, would exclude from the use of mankind at least nine-tenths of all the waters which a Higher Power has placed at our disposal. I have designed, as engineer, about 100 water-works in England and other parts of the globe, and have advised upon hundreds of other similar works; and, always paying the utmost attention to the chemical properties of the waters thus utilized, and, whenever possible, obtaining from statistical returns and medical observers the actual effects resulting from the use of the waters; I am compelled to come to the conclusion that the infinitesimal quantity of so-called organic carbon and organic nitrogen alleged to be found by a recondite and dubious process in ordinary potable waters—quantities amounting to a ten millionth or even a hundred millionth part—are not in the slightest degree prejudicial to the health of the people who drink them. This theory might safely be left to die a natural death, did it not happen that, in consequence of the plausible way in which it is often enunciated to inexperienced but influential persons, it has the effect of causing the rejection of excellent and easily avilable sources in favour of others often inferior in general usefulness, and commonly much more expensive than those for which they have become substituted. So, also, I reject, as ill-founded and absurd, the cognate and far-fetched doctrine of so-called "previous sewage contamination," because I have found, in the course of my practice, that the production of nitrates is caused quite otherwise than by the oxidation of the nitrogen contained in organic matter. In like manner, I reject as still more monstrous the assertion that the presence of chloride of sodium (common table salt) in water indicates the presence of sewage impurity. The whole of the earth's crust has, indeed, oftentimes been sunk below the level of the ocean, and has as often been re-elevated, bringing with it at each resurrection some amount, afterwards to be gradually dissolved out, of this very innocent and very valuable inorganic substance. I find the waters flowing from mountain heights where the foot of man has rarely trod, from deep and uninhabited valleys, and from shafts sunk into the bowels of the earth far removed from population, all charged with "previous sewage contamination" and the other innocent matters of which I have just spoken.

There is another characteristic of water worthy of a more than passing notice. I allude to its comparative hardness. The hardness of water is mostly due to the presence of the carbonates and sulphates of lime and magnesia. In respect to health, these salts are only occasionally present in such excess as to be injurious. The Rivington water, for instance, contains only about five or six grains of mineral matter in a gallon, but many perfectly good and wholesome waters contain three, four, five, or six times as much solid matter. I have from time to time examined with great care the mortality returns of the towns in which hard waters are used, and have carefully compared these with similar returns of the towns in which soft waters are used, with the almost uniform result that the mortality was the least in the group of towns supplied with the hardest water. The advocates of hard water supplies were, of course, jubilant, and, for a time, the advocates of soft water supplies were correspondingly crest-fallen. But subsequently, when I came to examine into the character of the occupations of the people, the conditions of their dwellings, and the peculiarities of their habits of life, I soon saw occasion to infer the invalidity of this determination.

I then turned for better information to the cases in which soft water had become substituted for the hard water previously used, and from that examination I was brought to the final conviction that, in respect to health, neither kind of water exercised any very perceptible influence. In regard, however, to comfort and economy, and to its utility for the purposes of trade and manufacture, water as soft as 4° of hardness possesses a decided advantage, still softer waters having the disadvantage of acting corrosively on metallic surfaces. On the whole, I think that waters of about 8° of hardness are the best that can be obtained for general application in domestic and manufacturing economy; but that, considered with regard to health alone, a very wide range in the hardness and solid constituents of water is admissible.

That the variability of health, as exhibited in the mortality returns of the Registrar-General, is rarely attributable to the state of the water supply, is sufficiently attested by the fact that, in the cases in which the water is obtained from a source of absolutely constant quality, as, for instance, from a chalk spring or from a sandstone well situated widely apart from population, the ups and downs in the records of weekly, quarterly, and annual deaths are precisely similar to those which occur in the case of river and surface supplies.

I am sorry to have been under the necessity of destroying in this practical way a considerable number of pretty but expensive theories. Truth is, however, to be preferred to fiction.

The rigidly prescribed hour allowed for the delivery of this address will not permit me to enter upon the subject of the geology of water, or to explain the progress of construction and invention in relation to water-works and water supply. I, therefore, now pass to another and a final topic.

On the matters of drainage and court-cleansing, as practised in Liverpool, I am not able to speak with personal authority, but I am well acquainted with the fact that the Health Committee of the Town Council have for many years given unremitting attention to these subjects, and that as a consequence of this persistent care, aided by a liberal expenditure of public money, the many defects of an older system of sewers are gradually but certainly disappearing; whilst, as to the condition of the courts inhabited by the least orderly and most disease-affected portion of the population, I cannot do better than quote the remarkable words of Dr. Parkes and Dr. Sanderson, who jointly reported on this subject as follows:—

"When, from the houses, we pass to the condition of the courts outside, it is impossible not to be struck with the contrast. Here the work of the corporation is seen at once. Most of the courts are well paved; many have stand-pipes for the supply of water (which at the time of our visit was always on); and galvanized iron receptacles, in which all the dry rubbish of the house is put, are placed in convenient situations. Almost every court is well drained. On laying bare and opening two court drains selected by ourselves we found that they were in perfect order, and that their channels were clear and entirely free from deposit.

"In many courts, walls, buildings, and even whole houses, have been removed during the last few years for the admission of light and air, and in this way a work of sanitary amelioration has been accomplished by the corporation, with the magnitude and importance of which we cannot refrain from remarking that we were very strongly impressed. Still, of course, the essential features of the labyrinth of courts remain, and can only be removed by demolition on a much larger scale."

One further observation, and my task is completed. It has been the habit of sanitary philosophers to regard the condition of the health of Liverpool as being exceptionally and pre-eminently "bad." The condition of the health of Liverpool is, however, I am glad to have the opportunity of stating, *not* "exceptionally and pre-eminently bad." Comparing the state of Liverpool with the state of the other large cities most nearly approaching to her in magnitude—namely, Manchester and Glasgow—what do we find? I will quote again from the Registrar-General's official returns; and, not to do an injustice to any one of these cities, I will append the *mean* of the deaths per thousand in each of them for the last seven successive years.

Years.	Liverpool.	Manchester.	Glasgow.
1869 ...	30·4 ...	30·7 ...	34·0
1870 ...	32·9 ...	29·8 ...	29·6
1871 ...	35·1 ...	31·2 ...	32·9
1872 ...	27·1 ...	28·6 ...	28·4
1873 ...	25·9 ...	30·1 ...	29·1
1874 ...	32·0 ...	30·4 ...	31·1
1875 ...	27·5 ...	29·9 ...	28·6
Totals ...	210·9 ...	210 7 ...	213·7
Means ...	30·1 ...	30·1 ...	30·5

It is thus established that in its sanitary *status* Liverpool does not rank below Manchester and Glasgow—two cities on an equal footing with herself in respect to water supply, drainage, street formation, and municipal government, although somewhat dissimilar in the occupations of the people and in the structure of their dwellings.

To what common causes, then, are we to attribute the equal excess of mortality to which the populations of all these great and important cities are subjected? I confess myself unable to answer with absolute certainty my own question; but I venture to suggest *the pernicious effects of overcrowding and habitual inebriety*. To the former I attribute the excessive waste of infant life, and to a combination of the two the correspondingly excessive waste of adult life.

For the mitigation of these considerable evils so seriously affecting the health and happiness of the industrial classes, we must look to better dwellings, thorough ventilation, improved legislation in respect to the traffic in intoxicating drinks, and the general education of the rising generation in habits of order, sobriety, cleanliness, and prudence, rather than to measures of compulsion and restraint.

PROXIMATE COMPOSITION OF COAL GAS.

By W. Dittmar, Professor of Chemistry in the Andersonian University, Glasgow.

[A Paper read before the British Association, Glasgow Meeting.]

In a memoir "Sur le Gaz d'Eclairage," which he published some months ago in the *Comptes Rendus*, M. Berthelot reports on a most elaborate proximate analysis of the Paris gas, which brought out the startling result that that gas contained only 3·7 per cent. of heavy carburetted hydrogens, and that this 3·7 per cent. included of—

Benzol	3·0 to 3·5 per cent.
Acetylen	0·1 "
Ethylen	0·1 to 0·2 "
Propylen and other hydrocarbons . .	0·02 "

In other words, the gas was found to contain only about 3½ per cent. of things *not* diluents, and that these 3½ per cent. consisted substantially of benzol only. Regarding the experimental evidence adduced, it may suffice here to state that the sum total of heavy carbides was determined by absorption with bromine, and that the volume of the benzol vapour was identified with the contraction suffered by the gas when shaken with fuming nitric acid.

From the numbers just quoted, it would appear that the Paris gas, as analyzed by Berthelot, has quite an exceptional composition, owing perhaps to an exceptional mode of manufacture. This, however, is not the view which Berthelot takes of the matter. He does not hesitate to extend his results as applying substantially to illuminating gas in general, these results, he says, being in perfect accordance with what he had found out long ago regarding the pyrogenic relations of carburetted hydrogens.

Now it so happened that at the time when Berthelot's memoir reached me, I was just engaged in collecting materials and apparatus for investigating, by synthetical methods, into the extent to which the several constituents of a coal gas contribute to its illuminating power. I accordingly read Berthelot's paper with the greatest possible interest, and at once decided upon looking into the matter.

I will begin by offering some remarks on the manner in which Berthelot tries to account for the fact that all previous coal gas analysts, instead of his few per *mille*, invariably found large per centages—sometimes as much as 10 per cent., and even more—of olefines. Berthelot's explanation is this: Until now analysts (in attempting to determine the composition of their olefines) have entirely relied on the eudiometric method of combustion, and "la traduction de leurs résultats par les noms de . . . . est absolument erronée comme reposant sur un simple jeu d'équations algébriques, calculées dans l'hypothèse de certaines inconnues qui ne sont pas conformes à la réalité." Now this, I think, is putting it rather strongly. It is quite true that gas analysts hitherto have not always kept quite alive to the obvious proposition that the combustion of a gas cannot by any means give us more than the quantitative elementary composition of the unit volume, and that consequently the reporting of so-and-so many per cents. of ethylen, butylen, &c., is nothing more than a rather clumsy *modus* of stating the volumes of carbon vapour and hydrogen in the part condensable by bromine or by fuming oil of vitriol. But is it possible to assume that in the many coal gas analyses which have been published by Bunsen, Landolt, Frankland, and others, the numbers which to these chemists served as a basis for their calculations should have been so entirely wrong as to enable them to turn into CnH_{2n} what in reality consisted mainly of C_2H_2?

Let us look at an example. Bunsen, in his "Gasometric Methods," gives all the details of a complete analysis of a sample of Manchester coal gas, in which his "ethylen" and "ditetryl" (C_4H_8) were calculated from the following data:—(After removal of H_2S and CO_2) 11·1 vols. of the gas gave up to fuming oil of vitriol 0·747 vol. To determine the carbon and hydrogen in this 0·747 vol. two combustions were made—viz., one of the original gas; and, secondly, one of the part not condensable by SO_3; and from the result it appeared that the "olefines," if burned by themselves, would have given—

A contraction of 1·747 vols.
CO_2 " 2·089 "

Now these numbers show that, whatever may have been its *proximate* composition, the elementary composition of the "olefine" was $C_{1\cdot05}H_2$ = say 0·75 vol. (which is near enough), and, neglecting the small excess in the carbon, we see that these numbers agree with the hypothesis that the absorbed gas consisted of—

C_3H_6=2 vols. of propylen, and
$\frac{1}{2}C_2H_4$=1 vol. of ethylen.

It is true there is room for a little benzol. To find a maximum limit for this potential benzol, let us assume the observational errors had made the carbon

too high and the hydrogen too low, and take $x = 1{\cdot}1$ and $y = 1{\cdot}8$, instead of 1·05 and 2·00 respectively. If we do so we find—

Benzol . . 0·13 vol.
Olefines . . 0·62 vol., containing $C_{0\cdot7} + H_{1\cdot4}$, or $C_{2\cdot35}H_{4\cdot53}$ in 2 vols.

We see that what was put down by Bunsen as so much of a mixture of C_2H_4 and C_4H_8 could not well be assumed to have contained much above 17 per cent. of benzol.

No doubt if we went to the trouble of re-calculating, in a similar manner, the coal gas analyses executed after Bunsen's method by Frankland, Landolt, &c., we should arrive at similar results. I prefer passing now to a series of experiments which I made for ascertaining to what extent Berthelot's views hold with regard to Glasgow coal gas.

The first experiment I made was to pass a current of the gas through a long column of nitric acid, of 1·5 sp. gr., into a glass gasholder, and then to compare the illuminating power of the product with that of the original gas, a "fishtail" burner being used in both cases. The flame of the de-benzolated gas was only very feebly luminous, which, at the time, I felt inclined to accept as strong evidence of the absence of any considerable quantity of olefines in the gas; but not feeling quite sure on this point, I tried some experiments on the luminosity of synthetically prepared mixtures of hydrogen and ethylen. To my surprise I found that the addition (to 1 vol. of C_2H_4) of only 3 vols. of hydrogen sufficed to bring down the luminosity to about the level of marsh gas, while a 10 per cent. ethylen flame was no more luminous than that of a Bunsen's lamp! On the other hand, a mixture of benzol vapour and hydrogen, which (by combustion of a measured volume with oxide of copper) had been proved to contain 3 per cent. of benzol vapour (equal in carbon to only 9 per cent. of C_2H_4), was found to give a brilliantly luminous flame.

These results render it highly probable that the light-value of a coal gas depends far more on the proportion of benzol than on the proportion of olefines contained in it. This, however, has nothing to do with the question on hand. More nearly related to it is an observation which I made incidentally in preparations of benzolated hydrogen. The 3 per cent. gas above referred to had been made by passing hydrogen slowly through a bulb apparatus charged with benzol, and kept at about 18° C. From the bulb apparatus the gas was made to bubble up through water into a gasholder. Now, according to Regnault's tension determinations, the gas should have contained about 10 per cent. of benzol vapour, and yet it contained only 3 per cent. I could not explain this otherwise than by supposing that the greater part of the vapour originally present had been dissolved out by the water in the gasometer. To test this hypothesis a quantity of benzolated hydrogen, kept over mercury, and proved by combustion to contain 6 per cent. of C_6H_6, was shaken with water and again analyzed. The per centage of benzol-vapour was reduced to less than 2.

After these experiences I felt convinced that, although coal gas as it comes out of the retort cannot help containing a considerable proportion of benzol, only very little of this vapour will survive the subsequent processes of purification. And having previously found that Glasgow gas when shaken with bromine contracts about 10 per cent., I had no doubt in my mind that the greater part of this contraction must be owing to olefines.

Wishing to determine the exact ratio in the gas between the benzol and the olefines, I tried very hard to find out a quantitative method for their separation from each other, but I did not succeed. That nitric acid of 1·5 is *not* the proper reagent for the purpose, a few experiments were sufficient to show—some made with pure ethylen, others with synthetically prepared mixtures of this gas with benzolated hydrogen of known composition. In all cases the acid was found to act on the ethylen, as well as on the benzol; no doubt, with formation of Kekulé's

$$C_2H_4 \left\{ \begin{matrix} NO_2 \\ NO_3 \end{matrix} \right.$$

and equally unfavourable results were obtained when 1·4 acid was substituted for the 1·5. For a time I thought an approximate separation, at least, could be effected with fatty oils or heavy paraffin oils, but it turned out an illusion; a considerable quantity of ethylen always accompanied the benzol in its absorption by these liquids.

The last substance I tried was non-vulcanized india-rubber, and, if I may trust a few preliminary trials, it *does* seem to have the power of abstracting the benzol from a gas without condensing much of the ethylen. I have, however, not yet found the time for trying *exact* quantitative experiments.

In order to form an idea of the proximate composition of the olefine portion of Glasgow gas, a current of it was made to pass (1) over dry chloride of calcium, (2) over a coil of sheet india-rubber, and (3) through a long slanting tube charged with bromine. The bromine soon got almost entirely converted into a liquid bromide, which was washed with dilute caustic soda, dried with fused chloride of calcium, and distilled. A *considerable* portion distilled below the boiling point of propylen bromide (142°). The per centage of bromine was found to be 83·52, whence, assuming the composition to be $CnH_{2n}Br_2$, we have—

$$CnH_2n = 31{\cdot}6;\ C_2H_4 = 28;\ C_3H_6 = 42.$$

When a weighed quantity was treated on a water-bath with alcoholic potash, a large precipitate separated out, which was found to contain more than half of the bromine originally present in the substance.

These experiments clearly show that the substance consisted substantially, *not* of mono-bromo-benzol (C_6H_5Br, which is *not* decomposable by alcoholic potash), but of bromides, $CnH_{2n}Br_2$, in which the lowest term, $C_2H_4Br_2$, must have been very largely represented.

From the foregoing it is clear that, contrary to Berthelot's assertion, the constitution of the heavy carburetted hydrogen portion in coal gas is pretty much what it has always been supposed to be.

APPARATUS FOR CLEANING FILTERING SAND.

By Mr. JOHN SANG, C.E., Kirkcaldy.

[Paper read before the Mechanical Section of the British Association, Glasgow.]

The construction of this simple machine will be understood by reference to fig. 1. An iron box is supplied with water under pressure from the pipe, P, and having as many small holes in its upper surface as to allow the whole supply to pass freely through them. The sides of the box are extended upwards to O O, and form a vessel for holding the sand to be washed. The charge of sand, S, is tipped from a gangway passing over the top of the box, and fills it about half-way up. On the sluice-valve being opened, the water fills the box, passes through the small holes, stirs up the sand, and moves it violently about, carrying the finer particles up nearly to O O, and the mud to the top of the machine, over the margins of which it flows along with the water. At first the overflowing water is muddy and dark, but it gradually becomes purer, and when it flows over quite clear, the sand is washed and ready for being placed in the filter. A charge of middling good pit sand is washed in two minutes.

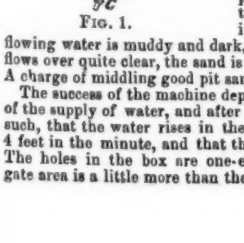


FIG. 1.

The success of the machine depends on its size being adapted to the magnitude of the supply of water, and after many experiments, I have found that it is best such, that the water rises in the box with a velocity of from 3 feet 9 inches to 4 feet in the minute, and that the height above the small holes be 27 inches. The holes in the box are one-eighth of an inch in diameter, and their aggregate area is a little more than the area of the supply-pipe.

On the water running off clear, and the sluice-valve being shut, a door, D, situated in the side of the box a little higher than the charge of sand, is opened to allow the water to run off quickly, and a small stopcock is also opened to drain away the part of the water which remains in the sand itself. The main door, M, is then opened, and the clean sand is dragged into wheelbarrows placed under the door, and is conveyed to the filter.

The sluice-valve is placed on an upward bend of the supply-pipe, with the view of its being safe from sand, but in practice I find that sand never finds way even in the small valve, C.

For the sake of economy it is preferable to have two machines, one of which the workmen are employed in charging while the other is in action. The advantages of this machine are the speed with which the sand is washed, and the thoroughness of the washing.

In the ordinary routine of filter management the mud which accumulates on the surface of the filter is scraped off about once a month. If the water be obtained from the surface of the ground through small upland brooks, this mud consists of a stiffish crust of about the tenth part of an inch in thickness. In scraping it off it is not possible for the workmen to avoid taking a little of the surface sand along with the mud, and by this means the body of the filter is gradually diminished. By spreading three or four piles of clean calico on the surface of a newly-scraped filter, and allowing them to lie there till next scraping, a sample of the mud free from sand may be gathered. On microscopic examination I find this to consist almost wholly of the minute water plants called diatoms. In the filters of the Kirkcaldy and Dysart Water-Works, where I have had this experiment carefully made, I find that 100 parts of the mud consist of about 95 parts of diatoms, 4 parts of animalcules, and one part of inorganic matter. Besides these particles there is the sarcoid matter of the diatoms, from which the offensive smell of the mud is derived. It is this sarcoid matter which constitutes the value of water for irrigation, and its paucity or abundance gives the qualities which agriculturists term poor or fat water. The machine described is unable to wash this impurity from the scrapings when present. I have been unable by the old machines or even in the laboratory to purify them by any mechanical means, and find that the only way of recovering the sand is to allow the stuff to lie exposed to the air for some years, turning it over occasionally until the sarcoid matter is decomposed. The flinty shells of the diatoms may then be removed by washing.

A portion of the mud which a filter is intended to remove passes into the sand, spreads through its interstices, and in course of years some of it even reaches the bottom. This mud consists nearly altogether of two kinds of very minute diatoms, orthosira, and cymbella. The larger kinds, such as synedra pleurosigma, &c., are caught, and remain on the surface of the sand. This sand may be at once distinguished in the microscope from fresh pit sand by their presence. The machine washes it quickly and thoroughly.

The preferable velocity of the water and the height of the box were determined from some hundreds of experiments made in the laboratory for some years past with a small machine used for the purpose of estimating the value of samples of sand forming town supply filters. The instrument is shown in fig. 2. A is a zinc vessel having marked on it a line to indicate the one-hundreth part of a cubic yard. It is filled with the sand up to this mark. B is a flexible tube attached to a water-pipe under pressure. C is a tube of zinc attached to B, expanded at the lower end, and having its flat base pierced with a few small holes. On the water being admitted to C it is placed in the vessel, and being supported in the hand it quickly pierces a hole through the sand for itself, till it reaches the bottom, where it is allowed to rest. The water and mud flow over into a large vessel, from which the time and quantity of water required to purify the sample is known.

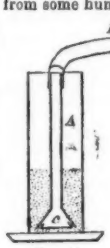


FIG. 2.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There is now a rather more settled tone in some branches of trade, consequent upon the temporary, at least, avoidance of war in Eastern Europe, a fact which will, in all probability, lead to the conclusion of as many transactions as can by any possibility be got through by the end of the year. It is felt, nevertheless, that we need not look for any great improvement this side New Year's Day, nor do present appearances justify the hope that the early part of 1877 will be characterized by any activity, so far as the iron trade proper is concerned. There are numerous inquiries in the market for various classes of ironwork, but the prices at which they are offered are such that it is practically impossible to secure any profit, hence makers are declining to accept them. In not a few instances, the orders ultimately reach the Belgians, who are certainly undersquoting us in numerous classes of goods, particularly constructive and railway ironwork.

Pig iron was rather easier at the beginning of the week, but some brands are now a little firmer, albeit considerable lots, or forward contracts for short periods may be negotiated at decidedly favourably figures. This is particularly the case with hematite pig irons and ordinary forge brands. The North Yorkshire pig iron producers now quote the following prices, at works or in railway waggons:—No. 1 foundry, £2 10s.; No. 2 foundry, £2 8s.; No. 3 foundry, £2 6s. 6d.; No. 4 foundry, £2 4s. 6d.; No. 4 forge, grey, £2 4s.; No. 5 forge, mottled, £2 3s. 6d.; No. 6 forge, white, £2 2s.; refined metal, £3 5s.; Kentledge, £2 11s.; and cinder, £1 18s. to £1 19s., all net cash.

About half the whole number of the local blast furnaces are now in steady work, and I hear that preparations are being made for relighting another or two, at or before the new year.

The foundries are steadily engaged, there being, amongst other articles, a fairly large output of gas and water pipes. The Sheffield Water Company are using a considerable quantity of four and six inch pipes at the present time, for the purpose of replacing old services and mains in various parts of the town.

The fuel market has been brisker during the week, owing to the sharp weather which has supervened. House coal is moving off much more vigorously, but prices are not generally stiffer. In isolated instances an extra shilling per ton has been imposed. Steam coal is being pushed off largely to the Baltic, Danish, and Swedish ports, in anticipation of the almost immediate closing of the navigation. Gas coals are steadier, at about former rates.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

It is only in exceptional cases where any advance has been made in prices this month, as the demand is not sufficiently brisk throughout the coal trade of this district to warrant any general upward movement; in fact, although some of the colliery proprietors are oversold, there are many who have still considerable stocks on hand, and at one or two of the pits and wharves in the Manchester district reductions of about 10d. per ton have been made to dealers. These, however, are exceptional cases, and generally quotations for round coal remain firm at the rates ruling last month. For best coal, suitable for house-fire purposes, there is a moderately good demand, and in gas coal there is no material change to notice since last week. Common coal is not quite such a drug, but it is still very plentiful, especially in the commoner sorts. For burgy an advance of 5d. and 10d. per ton has been asked by some of the firms in Manchester, and in one or two other quarters rather more money is being quoted

this month. This step, however, is scarcely justified by any increase in the demand, and higher prices can only be maintained by a reduction of the production, which some colliery proprietors are now doing by screening only for coal and slack. This latter description of fuel continues very plentiful in the market, and there is rather a downward tendency in prices. The average pit prices in the Wigan district for the present month may be given about as under:—Good Arley, 11s. per ton; Pemberton four-feet, 9s. to 9s. 6d.; common coal, 7s. to 8s.; burgy, 5s. 6d. to 6s.; and slack, 3s. 6d. to 4s. 6d. per ton.

For cokes, both local and north country makes, there is still a fair demand, without, however, any material improvement in prices.

In the iron trade, although there is no general demand of any importance from consumers, a fair amount is being bought by large houses who are anxious to secure forward deliveries at current rates, and with the exception of one or two common brands of iron which are difficult to sell, prices are firm at late rates. Lancashire pig iron delivered into the Manchester district is still quoted at from 56s. to 57s. per ton for No. 3 foundry, and 55s. per ton for No. 4 forge. For Lancashire bars delivered, quotations range from £6 15s. to £7 per ton, according to quality.

The probable agitation for an advance of wages in this district, to which I referred in a previous report, has now commenced, the newly formed Lancashire and Cheshire Miners Union having sent out notices to the colliery proprietors, asking that wages may be advanced equal to what they were in May last. With regard to the wages dispute in the Ashton district, the Bishop of Manchester, who was appointed arbitrator, has awarded a reduction of 1d. in the shilling in the price for getting coal.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

Last week there was a great detention of both steam and sailing vessels bound from the south to the coal ports of the North of England, through the strong north-west winds and stormy sea which prevailed. More than 50 sail of steamers, which were due in the Tyne on Sunday and Monday, did not reach that port until Friday morning. The same observation applies to the other ports on the coast. Down to Saturday, small coasters bound from the south were detained in Yarmouth Roads and the bays south of Flamborough Head from the same cause. Under these circumstances, great trains of trucks of coals had accumulated upon the standage at the docks. Friday and Saturday were, therefore, extremely busy days with the shipments. Most of the steamers would get away by Sunday. In consequence of the scarcity of tonnage, all kinds of coasting freights rose. As high as 8s. per ton was paid to small coasting vessels to discharge coals at the wharves in the Pool. Similar high figures had to be paid the few ships to hand to load gas coals for the east coast and British Channel. Coincident with this rise in freights was an extra demand for gas coals for the Mediterranean, and freights for steamers to load gas coals ran up, for Genoa and other ports, £2 10s. per keel, which was an extraordinary jump from the low figures previously paid. The price of gas coals is extremely firm, though there is no advance, nor likely to be, upon recent quotations. If there were tonnage in the market, the demand for household coals would become brisk, as there are a good few orders to hand. The steam coal trade has suddenly turned very slack. The Northumberland pits during last week scarcely worked half time. A lower figure had to be taken for second-class coals to make trade. It is probable that the steam coal trade will remain in this state for some time. Small manufacturing coals realize no more value in the market. In fact, they continue to be a drug.

There is not much special to note in the iron trade. Iron shipbuilding is improving, and there is likely to be an increased inquiry for plates. The railway orders for rails are limited. Very little manufactured iron, or any other class of manufactured goods, is shipped to the Continent. The chemical market is flat and dull again. Prices are tending downwards.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Little did I think, when writing the first paragraph in my last week's "Notes," that I should so soon have again to refer to Provost Bennett, of Dumbarton. This week I have to announce the mournful intelligence of the death of that gentleman, after having served for no fewer than five years as the Chief Magistrate of Dumbarton. It was chiefly through his indomitable energy that the gas supply of his adopted town was transferred to the Town Council. The undertaking, as shown in last week's "Notes," has been a very decided success, both to the annuitants and to the ordinary consumers.

A special meeting of the Police Commissioners of the Burgh of Johnstone was held last Thursday evening, for the purpose of considering and resolving as to the adoption of the Burghs Gas Supply (Scotland) Act, 1876, for that town. It was unanimously resolved, on the motion of Mr. James Fyfe Donald, seconded by Mr. Love, to adopt the Act. The commissioners have taken this step, after due consideration, with a view either to have the present gas-works transferred or to erect new works. For several years the quality and price of gas in Johnstone have been the source of much complaint. At present the price charged is 5s. 5d. per 1000 cubic feet, the rate having been 6s. 3d. some time ago. It is understood that the value of the gas company's stock is about £20,000.

The usual monthly meeting of the Dundee Gas Commissioners was held last week—Mr. Alexander Mitchell presiding. The chairman reported that a good deal had been done to improve the pressure to Lochee, but at considerable expense, owing to the great extent of the leakage. He considered that it was highly necessary that no time should be lost in obtaining powers to have such works carried out as would permanently improve the Lochee gas supply. It had already been resolved, he said, to promote a bill for that purpose. Notwithstanding that several factories had been closed, the consumption of gas was still on the increase, so that the commissioners might count on the further development of the concern with which they were entrusted.

Dr. Wallace's report upon the quality of the Glasgow gas, for the week ending Oct. 28, shows that on six occasions that supplied from the Dawsholm works was below 25 candles in its illuminating power. The highest maximum (31·10 candles) and the highest average (28·40 candles) were shown by the gas supplied from the Dalmarnock station.

The gas supplied to Edinburgh, on the 24th ult., by the Edinburgh Gaslight Company, had an illuminating power of 28·68 candles, and that of the Leith Company was 29·75 candles.

Another burst has taken place in the Lintrathan line of water-piping. This makes the 21st burst since May, 1875.

Dr. Littlejohn, Medical Officer of Health for the City of Edinburgh, has drawn the attention of the Public Health Committee to the scarcity of water all over the city, which he regards as a serious matter. The Edinburgh and District Water Trust have resolved to delay, in the meantime, the execution of the Denscleuch reservoir.

A good deal more firmness has lately been shown, both in the iron and coal trades. The price of iron has advanced very sensibly.

WEDNESBURY GAS SUPPLY.—At the meeting of the Wednesbury Local Board, on the 30th ult.—Mr. R. Williams in the chair—a memorial was presented from 250 ratepayers, requesting the board to take into serious consideration the propriety of obtaining in the coming session of Parliament the necessary powers to enable the board to purchase that portion of the gas undertaking of the Birmingham Corporation which is contained within the district of the board. The reasons assigned in the memorial in favour of the purchase were that, unless immediate steps were taken, it would hereafter be impossible to effect such purchase except by agreement with the corporation; that the introduction of the manufacture of gas would benefit the town by starting a new industry, affording additional employment, and adding to the rateable value of the district and the amount of capital circulating therein; that gas could in all probability be made at a considerable profit, which could be employed in reducing the rates or in effecting much needed improvements; and that the present arrangement with Birmingham was not satisfactory, inasmuch as Wednesbury had no share in the distribution of the profits made. After hearing a statement from the deputation in support of the memorial, the chairman reminded the board that there had been no change in the position of affairs since the matter was last discussed by the board, and a resolution unanimously come to not to interfere in the matter at all. The whole question, he said, was, could they buy gas cheaper than they could make it? Arguing from the experience gained in the course of the passing of the Birmingham Gas Bill and the negotiations with the district boards arising therefrom, he maintained that they could. Even, however, if that was an open question, they must not forget that if they purchased, the value of the plant would have to be arrived at by the uncertain process of arbitration; and until the working of that process had been tested in the case of the other district boards that were moving with the view to the making of gas on their own account, the best and safest course would be for the Wednesbury Board to sit still; and if, after all, they thought well to manufacture for themselves, they would be in as good a position, if not a better position, than some other boards to go for terms to the Birmingham Corporation, which they had worked amicably with, and with which they stood well. Another reason for not acceding to the prayer of the memorialists was that negotiations, of which he could not speak publicly, were going on with the outside districts by the corporation. In conclusion, he proposed a resolution to the effect that the decision already come to on the subject by the board should not be interfered with. The motion was carried without a dissentient.

Register of New Patents.

3833.—MACARTNEY, G., Greenock, "*Improvements in couplings for fire-hose or other pipes or tubes.*" Provisional protection only obtained. Dated Nov. 4, 1875.

This invention consists in introducing a cupped washer to act as a packing between the two parts of the coupling, combined with an improved contrivance for locking the parts, consisting of a pair of pins screwed through diametrically opposite lugs on one part of the coupling, so as to catch on a projecting ring or shoulder formed on the other part.

3838.—WHITE, W., Abersychan, near Pontypool, "*Improvements in apparatus used in the manufacture and distribution of gas.*" Patent dated Nov. 4, 1875.

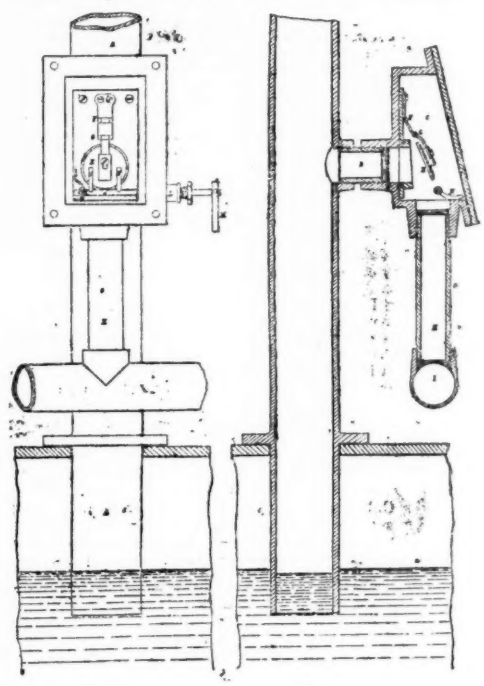


FIG. 1. FIG. 2.

This invention has for its object the application of means whereby the retorts when in action may be nearly or entirely relieved from pressure on the gas due to the dip in the hydraulic main when dip-pipes as ordinarily constructed or arranged are employed. It consists in attaching to the upper part of the hydraulic main, at any convenient part, a horizontal pipe or tube running either the whole length of the retort benches or divided into sections, each having a communication with a conducting main leading to the condenser or other apparatus. To each dip-pipe is fixed a box or chamber containing a flap valve, peculiarly hinged, and hung at a slight inclination to the vertical, and from this chamber is a vertical tube or pipe leading from the upper part of the chamber to the horizontal pipe. Each upright pipe may be furnished with a cock having a suitable lever for opening and closing the same, or means hereafter described may be used for shutting off the communication between the dip and the conducting gas-main.

It will be seen from the foregoing that each dip-pipe is thus provided with a bye-pass, the use of which and the apparatus generally is as follows:—When the retort is charged, the lid closed, and the lever cock, before referred to (if used), opened, the gas will rise in the ascension, pass into the dip-pipe, and thence by its pressure will open the flap valve and pass through the connecting pipes to the conducting gas-main, thus obviating the pressure on the retort caused by the gas in its effort to overcome the resistance of the liquid in the hydraulic main.

When the retort is to be discharged, the pressure being removed, the flap valve will fall and close the passage so that the bye-pass being thus shut, no gas can escape nor air enter the hydraulic in consequence of the seal to the dip; in fact, when the bye-pass is closed, the action of the apparatus is exactly the same as that at present ordinarily used.

It is also proposed in some cases to attach the hanging flap valve to the dip-

pipe within the hydraulic main above the water-level, and in that case the vertical and horizontal pipes may be dispensed with, the gas passing into the hydraulic by thrusting open the valve, in preference to descending further into the dip and through the liquid to the hydraulic main.

It will be seen that by closing the end of the dip the use of liquid in what is now called the hydraulic main may be superseded.

The hanging flap valve may also be used for automatically regulating the pressure in street-mains if attached to a box or chamber having a moveable lid, and into which the ends of the main are fixed, the valve being weighted or adjusted so as to give the requisite pressure.

In the above drawings, fig. 1 is a front elevation of the apparatus, the front of the valve chamber being removed in order to see the construction and arrangement of the valve.

Fig. 2 is a section of the dip-pipe, part of the hydraulic main, valve chamber, and horizontal conducting gas pipe or main.

In fig. 1, A is the dip-pipe, open at bottom, and allowed to enter and be fixed to the hydraulic main in the usual way. Attached to the dip-pipe is a short pipe B, seen in fig. 2, which connects the dip-pipe with the valve chamber C.

It will be observed, on looking at fig. 2, that the seat of the valve D is at a slight inclination from the vertical, so that the tendency of the valve is to keep closed. E is a flap valve hung by a strap, which is hinged both at F and G. This mode of hanging by double hinges ensures the valve, which is faced, always coming into close contact with the seat, and so producing a gas-tight joint, thus preventing the escape of gas or admission of air when the retorts are open. H is a pipe leading from the valve chamber to the pipe or gas-conducting main I, which is in communication with the hydraulic main or condensers.

In order to afford greater security against the opening of the valve E when the retorts are out of action a spindle J is provided, which works in a bearing K within the valve chamber, and passes through a stuffing-box L at the other end, and has at its extremity a heavy lever or weight M. The spindle is furnished with two tongues or projecting pins, N N, which when the apparatus is in action, lie out of the way, as depicted in fig. 2, but when it is desired that the valve shall remain closed the lever or weight M is turned in the opposite direction, thus bringing the points of the tongues N N against the valve E with such force as to withstand any pressure to which it may be subjected.

Another mode of ensuring the complete cutting off of communication between the dip and the conducting main I is by the insertion of a lever cock in the pipe H at or about the point O.

3850.—Bennett, J. T. B., Aston, near Birmingham, "*An improved retort and arrangements of retorts for manufacturing gas and other purposes.*" Patent dated Nov. 5, 1875.

According to this invention the retort is constructed of metal, clay, or other material, in any desired shape, sufficient thickness being left to allow the required hollows and projections to be formed upon it, and on each of the lower sides are formed, through the substance of which it is made, two holes running in a longitudinal direction, commencing at the front and terminating a short distance from the other end. Connected with these are smaller ones leading into the retort; these are for supplying the retort with air when it is desired so to do. Upon the two upper sides of the retort, at a convenient distance from the front, are two holes of a suitable size, which connect the retort with the chamber in which it is placed. When at work these can be opened or closed as desired by dampers so formed that they can, when closed, be made air-tight by means of luting being placed round the joints before they go in or through a suitable opening in the front of the damper. Upon the outer surfaces there are projections so that when two or more retorts are used in one bed the required apertures are formed to allow a large heating surface.

When used in a bed of more than one, the retorts are heated in the following manner:—The fuel is fired in the retorts, the dampers being open, and when the heat from the retorts has been fully circulated in the chambers or flues, the retorts are emptied and charged again with coal and fuel which is baked by the heat so generated, the dampers being closed. The gas passes up the ascension-pipe connected to the mouthpiece of the retort, into a suitable receiver. When it is found that heat is required in the chamber, the dampers of some of the retorts are opened. The ascension-pipes having previously been closed, air is then forced into the chambers through the blast-pipe, or is allowed to enter the retorts through the longitudinal holes. The air mingles with the volatile unburnt matter and causes combustion, and the heat so generated sustains the heat in the chamber or flues over the whole bed of retorts.

3857.—Urquhart, J., Manchester, and Andrews, W. W., Kingsland Road, London, "*Improvements in wet gas-meters.*" Provisional protection only obtained. Dated Nov. 5, 1875.

The objects of this invention are—1. To secure the more correct measurement of gas by causing the water or other liquid, both within and without the measuring chamber, to assume as nearly as possible the same level under varying or excessive pressures and speeds. 2. The simplification of the float arrangement to be applied to ordinary meters for cutting off the supply of gas, when the liquid is depressed below a certain level. 3. The prevention of gas from entering the index-box. 4. In an improved arrangement for opening or closing the inlet-valves of what are commonly known as Sanders and Donovan's compensating meters. 5. In improving the construction of the floats applied to the same meters.

3867.—Neuhaus, M., and Hodgkin, J. E., Queen Victoria Street, London, "*Improvements in steam-pumps, parts of which improvements are applicable to other similar purposes.*" A communication. Patent dated Nov. 6, 1875.

This invention relates more particularly to that description of steam-pumps or apparatus for raising liquids described in patents No. 2885, Oct. 1, 1872, and No. 2026, June 2, 1875, and has reference partly to the valves employed in the apparatus, an important object in the present invention being the constructing and arranging them and their seats and the parts in connexion therewith in such a manner as to admit of their being removed and replaced by others of a different construction to suit the nature of the liquid to be elevated or for any other required purpose. The invention may also be applied to other apparatus of a similar character in which the steam is brought into actual contact with the water or other liquid without the intervention of a piston, and parts of the invention are further applicable to valves to be employed for other purposes independently of pumps of this description.

3918.—Storey, J. H. and I., Manchester, "*Improvements in self-closing taps or valves.*" Patent dated Nov. 11, 1875.

This invention relates to valves adapted to be employed more particularly to control the supply of water, and especially to such valves as are constructed with a diaphragm which is caused to close the discharge opening by the pressure of water admitted to act upon the back of the diaphragm, the opening of the valve being effected by opening a small auxiliary valve which relieves the back of the diaphragm from the excess of pressure. In such valves there has been a discharge of water from the auxiliary valve during the periods when the main valve was opened, and this discharge has been objectionable in some cases. To remedy this defect the discharge is conveyed into the main discharge passage, and a diaphragm is employed to prevent the fluid from escaping through the opening through which the spindle of the auxiliary valve projects.

In one arrangement the spindle is tightly inserted in a hole in a disc of vulcanized caoutchouc, and the edges of the disc are nipped between a seating and a screwed cap, the disc preventing the escape of fluid, and at the same time permitting the necessary movement of the spindle. The closing of the auxiliary valve may be assisted by the action of a spring or weight or by the resilience of the disc, and in some cases the disc may be secured to the spindle by means of a nut or by other suitable means.

3924.—Warden, H. W., Bengal, "*Improvements in apparatus for igniting and extinguishing a number of gas-lamps simultaneously.*" Provisional protection only obtained. Dated Nov. 11, 1875.

According to this invention electric apparatus is employed, the gas being turned on and off by a ratchet worked by an electro-magnet. The ratchet may work round continuously in one direction, or the direction of motion may be reversed by means of apparatus in connexion with a diaphragm which closes an air vessel in the vicinity of the burner. If the electro-magnet works when the air in the vessel is expanded by heat the gas will be turned off, whereas if the air in the air vessel be cold the gas will be turned on.

3934.—Bennie, G., Glasgow, "*Improvements in retorts and their fittings and appurtenances connected therewith for the distillation of shale coal or other oleaginous or bituminous minerals or earths.*" Patent dated Nov. 12, 1875.

This invention consists of—1. The general construction and arrangement and combination of a set of two or more vertical retorts, ranged in one heating furnace or chamber over a hinged grate or hearth, so as to be heated wholly or partially by the residuary cinders discharged thereon from the retort. 2. The construction and use of hollow open or perforated tubes in the centre of retorts, for assisting the escape of the gases as evolved therein. 3. The closing and opening of the lower lid or door of retorts by a rod and lever within the retort, quite below the ordinary charging lid, and a hand lever outside. 4. The construction and use of hinged grates or hearths for the discharge of the residuary waste materials.

3963.—Thompson, I. C., Liverpool, "*Improvements in filtering and in apparatus therefor.*" Partly a communication. Patent dated Nov. 13, 1875.

This apparatus consists of a chamber preferably of enamelled iron attached to the main-pipe by a screw joint. The bottom being provided with a cock to empty it when desirable. A hollow carbon block is fitted inside this chamber, and a pipe is fixed into the block and after passing through the chamber walls is connected with the service-cock. The water enters the chamber, and the pressure forces it through the carbon block and out at the cock in a clear, full stream.

3969.—Eaglesham, J., Kilmarnock, and Rigg, H., Bonnyrigg, "*A new or improved mode and means or apparatus for cooling and lubricating air or gas-pumping machinery.*" Patent dated Nov. 15, 1875.

This invention consists essentially in the application and use of a jet of water led in with the air (preferably in the form of a spray) to the cylinders, chambers, or ducts of air or gas forcing and pumping machinery through which it passes, so as to moisten and cool the in-flowing air, and thus cool the whole apparatus, as well as lubricate the working surfaces of the cylinders and pistons. The mechanism for effecting this consists in the application of a valve and valve chest or jet apparatus connected to a water-pipe at its inlet branch, and at its outlet branch to the air cylinder, or ducts or chambers, drawing in the air or gas thereto, so as to regulate the flow of the jet of water. This by a rose on the outlet branch forms it into a spray as it is drawn in by the suction of the air, or is a forced by the jet to mix therewith, each stroke of the piston in the case of reciprocating air pumps; but in rotatory pumps it may flow in in a constant spray jet by the regular motion of their rotating pistons.

4028.—Melling, T., Aigburth, near Liverpool, "*Improvements in modes of and apparatus for regulating pressure in pipes or other conduits.*" Provisional protection only obtained. Dated Nov. 20, 1875.

This apparatus for diminishing the pressure at any desirable points in mains or pipes, containing water or other fluids, consists of a chamber, out of one side of which proceeds the exit-pipe, which is in free communication with the chamber. This chamber has a valve-seat above and below, and in each of these is a valve, the lower one being usually made smaller than the upper; but both are turned or fixed on the same spindle, which projects upwards through an outer stuffing-box to a lever. By lifting the spindle, both valves are raised simultaneously. The water from the delivery-pipe presses upon the upper surface of the upper valve, and on the lower surface of the lower valve; and, as the area of the former is greater than that of the latter, the pressure of the water on the back of it (when it is released from the lever) closes it and keeps it closed.

Connected with the exit-pipe is another cylinder, the axis of which is parallel to the axis of the valve spindle, and is fitted with a water-tight piston having a rod projecting outwards. Both the piston-rod and the valve-spindle are jointed to a lever with a moveable weight at one end. Their junction points with the lever are on opposite sides of the fulcrum, and as near as may be convenient to it.

The manner of working is as follows:—Pressure being exerted on the valves by the head of water in the main, the valves remain closed as long as the water in the exit-pipe is at or above its normal or required pressure, as regulated by the weighted lever. The instant, however, water is drawn from the exit-pipe the pressure falls slightly, and is no longer able by its pressure on the under surface of the piston, together with the unbalanced pressure of the head of water on the upper valve (after deducting the pressure on the lower valve) to counteract the effect of the weighted lever. The valves consequently open a little, and continue to admit water, so as to keep the pressure in the exit-pipe (acting under the piston) at the required pressure. The moment, however, the water ceases to be drawn from the exit-pipe, and the pressure therein rises ever so slightly above the normal pressure, the piston is raised, and the valves, being thereby released from the upward pull of the lever, are closed by the excess of pressure upon the upper over that under the lower valve, assisted by their own gravity, and any further rise of pressure in the main exit-pipe is thereby prevented.

4044.—Grundy, G., Tunstall, "*Improvements in carburetters.*" A communication. Patent dated Nov. 20, 1875.

This invention relates to certain improvements in apparatus for carburetting air or gas for the purpose of illumination and heating, its object being to thoroughly and uniformly charge the air or gas with the vapour of the hydrocarbon liquids—such, for example, as naphtha, benzine, and the like—in such a manner as to produce, when burnt, a brilliant and steady flame.

The apparatus consists of an open-mouthed vessel, formed of two concentric cylinders united to a common bottom, and so arranged that an annular space is left between the two for containing water, and in this annular space an ordinary gasholder is set. The inner cylinder, which forms the carburetting chamber, is constructed with a flaring mouth, the object of which is to prevent any hydrocarbon fluid being carried over into the annular chamber between the two cylinders, and thus to avoid waste. Near the bottom of the inner chamber there is arranged a distributing-box having discharge pipes, with an elbow or bend deflecting the air on the bottom of the carburetter in opposite directions, and making a thorough agitation of the hydrocarbon fluid.

4059.—Armstrong, R., Howden le Wear, Kellett, H., and Macfeggan, W. S., Darlington, "*Improvements in pumps, and in the apparatus to be used in connexion therewith.*" Patent dated Nov. 22, 1875.

This invention consists in improvements in the construction of pumps, whereby a direct-acting and reciprocating motion is obtained by means of wire ropes.

4061.—Tellier, A. Le, Brussels, "*Improvements in apparatus for purifying and filtering water, and treating sewage.*" Provisional protection only obtained. Dated Nov. 22, 1875.

This invention consists in improvements upon and further developments of the invention described in patent, No. 2496, July 16, 1874.

The first part of the invention relates to a simplified arrangement of combined purifying and filtering apparatus, in which such compound cylinders are arranged within an open tank or vessel having a lower chamber designed to receive the filtered water, and whence that water may be withdrawn through a suitable tap or otherwise. Within the open tank or vessel is arranged a chamber, in which is deposited lime or other purifying agent. Within this chamber is a tube or passage communicating with a receiver, and opening at the bottom into the lime chamber, the upper part of which has a spout or orifice, so that liquid may flow into the open tank. Above this spout or orifice is another leading from the receiver, and these two are arranged so that the liquid flowing from them shall mingle.

Sometimes the purifying arrangement is dispensed with, and the water fed directly into the open tank or vessel, whence it passes through the compound filtering cylinders into the receptacle for filtered water. It is then caused to flow from this receptacle by a suitable pipe or passage, and to percolate through a mass of granulated charcoal arranged in a lower annular chamber provided with a perforated top-plate. The water passes upwards through the charcoal and through the perforated plate into an annular receiver, whence the doubly-filtered water may be withdrawn as required.

In a modification of the last described apparatus, the vessel for unfiltered water has a cover, and the filtered water from the charcoal is caused by syphons to pass up and collect in an annular receiver surrounding the tank.

Apparatus for the treatment of sewage according to this invention is arranged to separate the solid matter, precipitate the matters in solution, and discharge into a river or elsewhere only clear and pure water. The sewage flows into a central chamber perforated at its upper part, and at its lower part provided with a pipe or passage for the discharge of residuum. In this central chamber large particles of matter will be deposited by gravitation. The impure liquid will overflow through the perforations into an annular chamber containing compound cylinders, the filtering medium of which consists of twisted hay bands rolled round the perforated metal cylinders in a peculiar manner. The liquid passing through these cylinders is received in an annular receptacle below, whence the filtered water may be allowed to flow into the river or elsewhere. The annular chamber containing the filtering cylinders communicates with an inclined ring-shaped chamber which receives the residuum. Around the upper part of the chamber containing the filtering cylinders is a pipe, with nozzles, for introducing suitable reagents into the chamber. Chemical reagents may also be fed to the central chamber, which is constructed with a convex cover, arranged to receive the pillar of a crane.

4065.—Pothetos, A., Naxos, Greece, "*Improvements in apparatus for and in the means of raising water.*" Patent dated Nov. 23, 1875.

The principal feature of this invention consists in the action of a cup-chain which to facilitate ascension is made to pass over a series of drums in such a manner as to form a screw, the object of such arrangement being to cause the greater part of the weight of the raised water to be borne on the axes of the drums, so that all the force that is required is merely that which is sufficient for the traction of the chain. In ordinary chain pumps the weight of the raised water acts directly and tangentially on the drawing or driving drum, whilst in the present case this drum only bears the strain consequent on the conveyance of the chain.

4068.—Scott, T. S, Temple, London, and Poilly, E. De, Boulogne-sur-Mer, "*Apparatus for the instantaneous lighting of gas burners in towns, theatres, public rooms, private dwellings, and other places, applicable also as an automatic gas-gauge.*" Provisional protection only obtained. Dated Nov. 23, 1875.

The object of this invention is to effect the instantaneous lighting of gas-burners by means of the mere variation of pressure, and to gauge that pressure. The apparatus is screwed into the supply-pipe, and brings the gas under a bell-cap, or into a chamber divided by a diaphragm, or fitted with a valve. The bell-cap dips under the liquid, and is provided at the top with a tube. These are soldered together, and rest on the pipe by means of a ring with shoulders or epaulments which form part of such pipe. A metallic, glass, or other tube of small diameter, ascends to the main burner, either internally or externally, as may be necessary, and has an opening of the size of the point of a needle or minute gas nipple. A bell with an opening in the top of the cap communicates with the pipe of the main burner, and a chamber communicates with the outer air by a hole of the size of the point of a needle made in the screw-cap. By this the liquid, which may be water, oil, or mercury, or any other fluid substance, is supplied to the chamber. A double casing is provided with compartments containing substances which are non-conductors of heat, and this casing is screwed on the base of a chamber fixed on a metal circle or roundle. The latter usually is screwed into the top of the lamp-post, but it may be applied in any situation or position in accordance with the main supply-pipe.

4083.—Thorneloe, G., Barbican, London. "*Improvements in gas, water, and steam valves.*" Patent dated Nov. 24, 1875.

This invention consists of a self-cleansing valve in the shape of a hollow cone, force being applied in the apex. The valve-seat is turned true or otherwise, and the cleaning brush is so arranged as to clean off every particle of dirt, &c., from the valve seating, thus ensuring a perfectly tight and always clean valve. The valve may be moved to and fro by means of a rack and pinion screw, or by any other method.

4117.—Lake, W. R., Southampton Buildings, London, "*Improvements in the manufacture of illuminating gas and in apparatus therefor.*" A communication. Provisional protection only obtained. Dated Nov. 26, 1875.

This invention relates to the manufacture of illuminating gas from liquid hydrocarbons, by the commingling of superheated steam and hydrocarbon vapours evaporated by the action of the superheated steam on the surface of the liquid hydrocarbon, and by decomposing the commingled vapours into a fixed commercial illuminating gas in red-hot retorts. This object is accomplished by utilizing the light vapours of liquid hydrocarbons obtained by a natural evaporation from the surface of an undisturbed body of a liquid hydrocarbon, and by the expansion and rarification of these vapours by superheated steam. Heavy vapours, by the excess of carbon in them, cause the formation of lamp-black, pitch, and a thick viscous tarry substance which obstructs the retorts, stand-pipes, hydraulic main, condensers, washers, and purifiers, causing trouble and expense, and at times stopping the manufacture of gas. They also make a heavy smoky gas, surcharged with undecomposed vapours, which are subsequently condensed in street mains and consumers meters, causing additional trouble and injury, while the light vapours utilized make a fixed commercial gas free from injurious vapours and smoke, of brilliant quality, and of a light gravity to burn in ordinary coal-gas burners.

4126.—Butt, J. M., and Herring, J., Gloucester. "*Improvements in apparatus used in the purification of gas.*" Patent dated Nov. 27, 1875.

The object of this invention is the improvement of apparatus whereby gas may be more completely purified, and is specially designed for washing condensed gases in the crude state with alkaline solutions, or may be used to wash gas after it has passed through the ordinary course of purification. It consists of a series of separate compartments placed above each other, each compartment containing a regulated depth of alkaline or other solution. The gas entering the bottom compartment by one or more inlet-pipes is brought into contact with a longitudinal division plate perforated below the level of the water-line. Attached to this is a submerged plate, so arranged that the gas after passing through the division plate is driven to the other side of the washer under the submerged plate, and into the other compartments in their order. The perforations in the longitudinal plates are preferably made of a circular shape of about one-quarter of an inch, more or less, in diameter, so as to break up the gas into as many separate streams as possible, and are so placed that the aggregate area of the perforations shall more than equal the area of the inlet or outlet pipes. The liquor used in the washer enters at the top compartment, and passing through it flows through a regulated valve into a bent sealed tube connected with the second compartment, and in the same manner to the bottom compartment. To render the action of the apparatus fully effective, two or more washers may be connected and used so as to ensure the more complete removal of all impurities from the gas.

4265.—Kidd, J., Dartmouth Street, and Hearson, C. E., Strand, Westminster, "*Improvements in gas-burners for burning hydrocarbon vapours and gases.*" Provisional protection only obtained. Dated Dec. 9, 1875.

In these improvements the inflammable vapour or gas is admitted by a pipe to the bottom of a cylindrical chamber, from the top of which rises an annular tube up through which it passes freely and is ignited as it issues at the top. Air is admitted to the central space enclosed by the annular tube through three passages passed radially through its lower end and at equal distances around it. The centre of this space is occupied by a vertical rod or closed tube rising up from the top of the cylindrical chamber to the level of the top of the annular burner-tube or thereabouts. Above the three air passages is carried the gallery for supporting the glass, having numerous small holes formed through it for admitting air to the exterior of the flame.

The top of the annular burner-tube may either be left entirely open or be closed and have numerous small holes formed through it, and sometimes a cone for regulating the external air supply is used, either in conjunction with the perforations or alone.

4298.—Weyhe, W., Bremen, "*Improvements in motor engines worked by steam, air, gas, or other fluid, also partly applicable as pumps or blowing-engines.*" Provisional protection only obtained. Dated Dec. 11, 1875.

According to this invention a cylindrical piston is caused by fluid pressure to revolve in an annular passage formed by bolting face to face two discs having each a semicircular recess round their peripheries, and which constitute the casing of the engine. Between the central parts of the two discs is placed another disc fixed on a shaft passing through the casing, and to this is fixed the piston, the rotation of which consequently causes the disc and shaft to revolve. At one point of the annular passage a slide is made to project so as to act as a division, and on one side of the slide is the inlet port for fluid pressure, while an escape port is provided on the other. The piston has a beak or incline, which as it passes round in the passage, pushes up the slide so as to allow the piston to pass through, the slide closing again by the action of a spring. Arrangements of pipes and heating and cooling apparatus are described in conjunction with a duplicate engine to adapt it as a caloric engine, the one engine acting as a pump. A modification of the engine is also described for adapting it to be worked by explosive mixtures of gas and air.

4303.—Blewitt, R. J., Upper Norwood, Surrey, "*An improved method of obtaining carburetted hydrogen and olefiant gases arising from the distillation of coal.*" Provisional protection only obtained. Dated Dec. 11, 1875.

The object of this invention is to avoid the formation of the smells occasioned by distilling coal for the purpose of obtaining carburetted hydrogen and olefiant gases and to effect the distillation in a more correct and less wasteful manner.

The method consists in distilling the coal in ordinary coke ovens instead of in retorts as at present, and in leading into iron mains the gaseous products as they are formed during the rise in temperature of the ovens. The gases so led away consist of carburetted hydrogen and olefiant gases, carrying with them products capable of being used in numerous ways, especially for dyeing. These are then treated in the ordinary manner their various constituents being extracted in the most convenient way.

4314.—Anderson, J., Glasgow, "*Improvements in stop-cocks or valves.*" Patent dated Dec. 13, 1875.

In these improvements the closing detail is a diaphragm or washer of vulcanized rubber or other suitable flexible material, held and acting as in what is known as the Lambert tap. The diaphragm has a metal centre or spindle attached to it, and this is connected by a screw to an upper spindle. The cover is made with a cavity, in which a spring is placed. The spindle is lifted by a contrivance, consisting of a double rolling cam, formed with a handle, and jointed by a cross-pin to the valve spindle. A small bore is formed through the metal centre of the diaphragm, so as to communicate with the space in the cover, and when the handle is let go, after opening the valve, the spring nearly closes the diaphragm, but without suddenness or concussion, and immediately afterwards the water or fluid getting to the upper side through the small bore in the metal centre ensures the complete and tight closing of the diaphragm.

4317.—Cort, J., Great Dover Street, Southwark, "*Improvements in valves.*" Provisional protection only obtained. Dated Dec. 13, 1875.

The features of novelty in this invention consist in fixing to the screw-socket of a disc-valve a lever or handle, by means of which a to-and-fro motion may be given, so that as the valve is being closed the disc will rub away the dirt which is deposited on the seat, which, instead of being bored out to receive the disc, is left square. A cam or lever is fixed on a spindle inside the valve-chamber, and on being moved round, lifts up the valve to open it, or allows it to fall in the seat to close it.

4341.—Morgan-Brown, W., Southampton Buildings, London, "*An improved filtering reservoir.*" A communication. Provisional protection only obtained. Dated Dec. 15, 1875.

This filtering reservoir consists of a case wherein, at a short distance from the bottom, an appropriate filtering medium is inserted, and above a space is reserved which acts like an air vessel. The water is introduced by a pipe from below, and traversing the filtering medium enters the upper chamber, gradually compressing the air therein contained. The lower chamber situated below the filter can be cleansed of the matter separated from the water or other liquid filtered, by means of a pipe provided with a cock.

4342.—Alexander, E. P., Southampton Buildings, London, "*Improvements in gas motive power engines, and in the means for regulating and transmitting their motion.*" A communication. Patent dated Dec. 15, 1875.

This invention comprises—1. Increasing the speed of the action of the explosive mixture of air and gas upon the piston by increasing the length of stroke of the piston, and reducing its surface in the same proportion. 2. The preliminary heating of the engine before starting, by a gas-stove or other means of applying heat. 3. The substitution of large radiating surfaces for cold water, for moderating the temperature of the engine when at work. 4. The use of a peculiar arrangement and combination of return connecting-rod, crank, and slide block, for transferring the motion of the piston to the crank-shaft. 5. A mode of distributing the air and the gas by a single equilibrium slide-valve and arrangements for bringing the air and the gas to such valve. 6. Special arrangements and constructions of air and gas-valves 7. A peculiar combination of appliances for driving one or more machines having an intermittent working, such as sewing-machines and the like, from a single gas-engine, and for regulating the supply of gas in accordance with the demand.

4362.—Colls, F. W., Erith, Kent, "*Improvements in the manufacture of gas for heating and lighting, and in the apparatus to be employed therein.*" Provisional protection only obtained. Dated Dec. 16, 1875.

This invention relates to certain improvements on patent No. 1533 April, 28, 1873, the object being to produce gas from chalk or carbonate of lime in combination with superheated steam and hydrocarbon or other oil or spirit, and coke or

charcoal, or other carbonaceous materials, and in some instances metal. It is proposed to use gas-retorts set either, vertical or horizontal, one of which is to be charged with chalk or limestone, and a second or carburetting retort with charcoal, coke, or any other carbonaceous materials, and the two retorts are to be connected by a suitable pipe. In some instances it is purposed using a third retort, through which the combined gases are passed.

At a short distance from the retorts a tank or reservoir containing hydrocarbon or other oil or spirit is fixed, and connected by a pipe with one of the gas-retorts. A syphon gauge is applied to the tank to regulate the supply, and a pipe is connected with one of the retorts, to supply superheated steam to it. An outlet-pipe from the carbon retort is connected to the exhauster, and thence to the gasholder. Heat is applied to the retorts by means of furnaces, and when it is sufficiently high a small stream of oil or spirit is supplied; at the same time superheated steam is admitted to the retort, and the exhauster put into action. The result is that the oil or spirit with the superheated steam, in passing through the retorts with the carbonic acid generated from the chalk, becomes decomposed, the carbonic acid is converted into carbonic oxide and the steam into hydrogen, the whole combine to form carburetted hydrogen and carbonic oxide gas of a highly illuminating power, and free from sulphur and ammonia impurities.

4401.—Steel, J., Glasgow, "*Improvements in charging and drawing retorts, and in the machinery or apparatus employed therefor, also in the means of opening and closing retorts.*" Provisional protection only obtained. Dated Dec. 18, 1875.

This invention consists, as regards the machinery or apparatus whereby the charging operation is effected, of a hollow cylinder or tube, which may either be straight or curved throughout its length, and laid horizontally or inclined. One end of it is situated near to the mouth of the retort which is to be charged, and into it one or more annular jets or nozzles are introduced. Behind these jets or nozzles a hopper is situated in communication with the cylinder or tube, and in the hopper the coal is placed. When it is desired to charge a retort, through the nozzles or jets, steam is introduced, which, by its inducing action, forcibly draws the coal from the lower end of the hopper and through the hollow cylinder or tube, so that it becomes deposited within the retort. The apparatus may be mounted on a carriage or truck running on rails or otherwise in front of the bench of retorts, or it may be suspended by ropes or chains from the roof of the retort-house. Under either arrangement the mechanism is capable of being raised and lowered to the level of different retorts in the series. A screen may be provided at the charging end of the apparatus, to protect the operator from the steam escaping at that end, and also from the heat of the open retorts.

As regards improvements in machinery or apparatus for drawing retorts, the invention consists under one modification of a tube or hollow rake, to one end of which a flexible pipe communicating with a steam-boiler is secured. The opposite end is bent downwards, and formed with one or more holes or openings made parallel with, or at an angle to, the length of the tube. When it is desired to withdraw the charge from the retort, the bent end is pushed through the retort-mouth; a cock or valve is then opened so as to admit steam, which blows or forces the charge out of the retort. Under another modification the tube or hollow rake is dispensed with, and the flexible pipe is provided with a cock or valve and with a nozzle, through which the steam passes into the retort to blow or force out the charge therefrom.

The invention further relates to means or apparatus for opening or closing retort-mouths, and consists in forming the retort-mouth bevelled or inclined upwards or downwards, and in closing the same with a correspondingly inclined door, which when it is desired to open the retort, slides upwards or downwards in guides. By so forming the lid and retort-mouth the end of the lid in closing scrapes against the mouth, and removes therefrom any adherent grit or matter; a close sealing of the lid is thereby obtained.

4414.—Godfrey, S., and Howson, R., Middlesbrough-on-Tees, "*Improvements in gas furnaces.*" Patent dated Dec. 20, 1875.

This invention relates to that class of furnaces in which the gas is inflamed by means of forced jets of air. The leading general features of the invention are common to both rotating and stationary furnaces, but the improvements comprise modifications demanded by each variety, and are not describable apart from the drawings.

4418.—Barlow, H. B., Manchester, "*Improvements in the construction of filters.*" A communication. Patent dated Dec. 21, 1875.

This invention consists of a cast-iron chest having at each side a passage for the admission of the liquid to be filtered, and two passages below for the discharge of the filtered liquid; there is also a passage above for rinsing out water. The filtering surfaces consist of a series of sheet metal frames covered with flannel or other suitable porous material, secured by air-tight sockets to the bottom of the chest.

4420.—Ramsay, H. M., Twickenham, Middlesex, "*Improvements in filters, and in the mode and means for effecting the filtration and purification of clear sewage, river, or other water, or liquids.*" Provisional protection only obtained. Dated Dec. 21, 1875.

This invention relates to the construction of one or more tanks (in number and size as necessary for any locality) for the reception of clear sewage water, or liquid, after previous treatment and deposition at outfall reservoirs or other works by which all matter in suspension or like impurities have been removed by the use of lime or other precipitate.

The sewage water, or liquid, having been so treated, is collected and discharged through conduits or pipes into a filter chamber attached to or connected with the inlet shaft to each tank (the chamber being charged with loose charcoal or other suitable substance), the filtered sewage then flowing down the inlet shaft into each tank, and filling or charging the same to the necessary level for obtaining pressure or otherwise. Each tank is fitted up with a floor or platform at the requisite height above the bottom of it, and is perforated at certain distances for the reception of hollow filter cylinders made of porous plastic carbon or other filtering material. The tanks being charged, the clear sewage water, or liquid is forced through into the interior of each filter, flowing thence and discharging into outfall drains or other receptacles.

APPLICATIONS FOR LETTERS PATENT.

3863.—Turner, A. D., Dalston, London, "Improvements in apparatus for burning hydrocarbons for lighting and heating purposes." Oct. 6, 1876.

3880.—Green, H., Preston, Lancs, "Improvements in coal-gas scrubbers and apparatus for distributing liquid for other purposes." Oct. 7, 1876.

3882.—M'Kendrick, J., and Ball, H. W., Glasgow, and Watson, R. G., Kilmarnock, Ayr, "A new or improved fluid motor, pump, or meter, and valves and valve-gearing therefor." Oct. 7, 1876.

3884.—Martin, J. R., Shoreditch, London, "Improvements in rotary pumps and engines." Oct. 7, 1876.

3894.—Young, W., Neilson, A., and Young, A., Clippens, Renfrew, "Improvements in the destructive distillation of bituminous substances, and in the apparatus or means employed therefor." Oct. 9, 1876.

3905.—Wildy, W. L., Cannon Street, London, "Improvements in cocks or valves for gas-fittings." Oct. 10, 1876.

3914.—Ahrbecker, H. C., Stamford Street, London, "Improvements in fluid-meters." Oct. 10, 1876.

3916.—Shand, J., Blackfriars Road, London, "Improvements in hydrants or fire-cocks, and an auxiliary valve in connexion with the same." Oct. 10, 1876.

3939.—Barnes, J., Acerington, Lancs, "Improvements in water or other fluid meters or motors." Oct. 12, 1876.

3949.—Brook, E., and Wilson, A., Middlesbrough-on-Tees, York, "Improvements in apparatus for making gas." Oct. 12, 1876.

3958.—Wolstenholme, J., Radcliffe-Bridge, Lancs, "Improvements in steam-pumps or pumping-engines." Oct. 13, 1876.

3965.—Steel, J., Glasgow, "New or improved apparatus for purifying and condensing gas, and for extracting and collecting ammonia therefrom." Oct. 13, 1876.

4002.—Penning, J. R., Landport, Portsmouth, "Improvements in apparatus for indicating the pressure of elastic or non-elastic fluids." Oct. 17, 1876.

4014.—Howard, J., Peckham, Wilson, A. F., and Kingdom, H. W. A., Southwark, London, "Improvements in apparatus for controlling and arresting the flow of fluids and prevention of waste of water." Oct. 18, 1876.

4015.—Reynolds, E., Sheffield, "Improvements in centrifugal pumps and fans." Oct. 18, 1876.

4032.—Henderson, R., Bath, Somerset, "An improved tap for measuring, regulating, registering, ventilating, and preventing the waste of fluids and liquids." Oct. 18, 1876.

4036.—Vandendriesche, A. E., Lombard Street, London, "An improved gas-regulator designed for the purpose of being applied to burners of every description without altering the original appearance of the fittings." A communication. Oct. 19, 1876.

4056.—Tylor, A. and J. J., Newgate Street, London, "Improvements in apparatus and arrangements for measuring and recording the movements, speed, and quantity of substances, liquids, and fluids." Oct. 20, 1876.

4070.—Alley, S., Glasgow, "Improvements in and connected with sluice and other valves, and in machine tools for making them." Oct. 21, 1876.

4071.—Schlenker, E., New York, "An improved screw-cutting and nut-tapping machine." Oct. 21, 1876.

4085.—Sievier, J. C. H., Holloway, London, "Improvements in the manufacture of gas, and in the apparatus to be employed therein." Oct. 23, 1876.

4087.—King, J. T., Liverpool, "Improvements in chandeliers, brackets, and bracket arms, and in apparatus employed in the manufacture of the same." A communication. (Complete specification.) Oct. 23, 1876.

4089.—Balcon, W., Kingsland, London, "An improved lamp-lighter." Oct. 23, 1876.

4095.—Burden, G. T., and Nowell, J., Birmingham, "Improvements in meters for measuring water and other liquids." Oct. 23, 1876.

4106.—Leoni, S., New North Road, London, "Improvements in the construction of boilers to be heated by gas." Oct. 24, 1876.

4109.—Walker, J., Glasgow, "An improved fluid-meter." Oct. 24, 1876.

4115.—Simcox, E., Birmingham, "Improvements in the manufacture of taps and cocks." Oct. 24, 1876.

4180.—Boyes, W., Manchester and Bolton, "Improvements in apparatus for purifying and heating water." Oct. 28, 1876.

4203.—Watson, J., Seaham, Durham, "Improvements in the treatment and utilization of sewage." Oct. 30, 1876.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1566.—Tylor, A., Newgate Street, London, "Improvements in water-closets, lavatories, and other apparatus relating to sanitary arrangements, and the parts connected therewith, relating to the containing, measuring, controlling, arresting, and more convenient supplying of water and prevention of waste of the same." April 13, 1876.

1569.—Newton, H. R., Seymour Street, London, "Improvements in apparatus for supplying and regulating water, filtered or unfiltered, to houses, and in locking or fastening apparatuses therefor." April 13, 1876.

1618.—Macneill, Sir J., Kt., South Kensington, London, "Improvements in apparatus for measuring and registering the flow and supply of water to consumers, or for other purposes." April 18, 1876.

1730.—Stannah, J., Southwark, London, "Improvements in donkey-engines and pumps." April 24, 1876.

1740.—Blackie, J. K., Glasgow, and Robertson, J., Govan, Lanark, "Improvements in service cisterns and valves for regulating the supply of water for water-closets and other purposes." April 25, 1876.

1783.—Muller, J. A., Amsterdam, Holland, "A new or improved method for the manufacture of gas and fuel from rice husks." April 27, 1876.

1811.—Erskine, F., Manchester, "Improvements in or applicable to steam-boiler and other furnaces for consuming smoke, also partly applicable to the manufacture of gas, to ventilating mines, and for utilizing and purifying noxious vapours and gases, and rendering the same innocuous and non-explosive." April 29, 1876.

1827.—Hughes, E. T., Chancery Lane, London, "A new or improved gaslight extinguisher." A communication. May 1, 1876.

1930.—Clark, W., Chancery Lane, London, "Improvements in treating sewage water to obtain valuable products therefrom." A communication. May 8, 1876.

2000.—Morgan-Brown, W., Southampton Buildings, London, "An improved filtering reservoir worked by compressed air." A communication. May 12, 1876.

2050.—Morgan-Brown, W., Southampton Buildings, London, "Improvements in self-closing valves." A communication. May 16, 1876.

2497.—Tylor, A., Newgate Street, London, "Improvements in apparatus and arrangements for controlling, regulating, and arresting the supply of water for sanitary, domestic, and other uses, and preventing waste." June 16, 1876.

2691.—Anderson, C., Leeds, "An improved means or apparatus for connecting and disconnecting gas, water, or other pipes." June 30, 1876.

3087.—Arding, F., Jeffrey's Square, London, "An improved coupling or union for pipes or hose." A communication. Aug. 2, 1876.

3145.—Cathels, E. S., Montreal, Canada, "Improvements in apparatus used in the purification of gas." Aug. 9, 1876.

3173.—Young, W., Clippens, Renfrew, "Improvements in carburetting air and gases, and in the mechanism or apparatus employed therefor." Aug. 11, 1876.

3250.—Rogers, B. W., Stourport, Worcester, "Improvements in braces for drilling." Aug. 18, 1876.

3307.—Staples, H., Belsize Park, London, "Improvements in the purification of sewage liquid, night-soil, urine, and other foul waters or liquids, and in the manufacture of precipitating agents to be used therein." Aug. 23, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3077.—Martin, J. W., "An improved tube expander and stopper." Sept. 19, 1873.

3086.—Fottrell, J., "An improved composition for the manufacture of pipes and tubes, suitable for water at high pressure, and as conduits for sewage purposes, gas, brine, and other saline liquors." Sept. 20, 1873.

3119.—Michel, C., and Frager, A., "An improved meter or apparatus for measuring the flow of liquids." Sept. 23, 1873.

3185.—Voigt, F. G., "Improvements in apparatus used in the production of gas from hydrocarbon liquids." Oct. 1, 1873.

3224.—West, J., "Improvements in apparatus used in the manufacture of gas." Oct. 4, 1873.

3264.—Gardner, H., "Improvements in treating air for the production of hydrocarbon gas, and in apparatus or appliances therefor." Oct. 8, 1873.

Share List of Metropolitan Gas and Water Companies.

(*Corrected by Mr.* F. N. Golding, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	Gas Companies.	£ s. d	£ s. d	£		£	Gas Companies.	£ s. d	£ s. d	£		£	Gas Companies.	£ s. d	£ s. d	£
10000	20	Anglo-Romano . .	20 0 0	9 0 0	16–18	5800	10	Hong Kong (Lim.)	10 8 0	10 0 0	15–16	9000	4	Unit. Genl., Limrck.	4 0 0	2 10 0	2¼–3
5000	20	Bahia (Limited). .	20 0 0	2 0 0	12–13	56000	50	*Imprl. Continental*	43 15 0	9 10 0	88–90	1500	10	*Wandsw. & Putney*	10 0 0	10 0 0	19–20
1000	20	Do., do., redeem.	20 0 0	2 0 0	25–27	378350*l.*	Sk.	*London*	100 0 0	10 0 0	210–215	1500	10	Do.	10 0 0	7 10 0	11–12
1500	20	Do., 2nd pref. .	20 0 0	7 10 0	19–21	150000*l.*	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	135–141	2957	10	Do.	10 0 0	7 0 0	..
40000	5	Bombay (Limited).	5 0 0	7 10 0	7–7¼	14450	Sk.	Do., 2nd pref. . .	100 0 0	6 0 0	..	993	10	Do.	3 0 0	7 0 0	..
10000	5	Do., fourth issue.	4 0 0	7 0 0	5¼–5¾	4350	Sk.	Do., 3rd pref. . .	100 0 0	6 0 0	..	16000	5	*West Ham*	5 0 0	10 0 0	8–8⅛
10000	20	British (Limited) .	20 0 0	10 0 0	40–42	7622	25	Do., A shares . .	12 10 0	6 0 0	33–34	10000	5	Do., new shares .	2 10 0	10 0 0	3–4
7500	20	Cagliari (Limited).	20 0 0	5 0 0	..	26805*l.*	All	Do., Debent. stk.	100 0 0	5*l.* & 6*l.*	8–10 pm.						
550000*l.*	Sk.	*Commercial*	100 0 0	10 0 0	210–215	15000	5	Malta and Mediterranean (Limited).	5 0 0	2 0 0	2⅞–3¼						
70000	100	Do., 7 per cent. .	..	..	..												
20000	20	Continental Union.	20 0 0	6 0 0	22½–23½	6000	5	Do., preference .	5 0 0	7 10 0	4¾–5¼						
10000	20	Do., new	12 10 0	6 0 0	2–2½ pm.	20000	5	Mauritius (Limited)	2 0 0	..	1–2						
10000	20	Do., preference .	20 0 0	7 0 0	27–29	25000	20	Monte Video (Lim.)	20 0 0	8 0 0	18½–19½						
75000	Sk.	*Crystal Palace District*	100 0 0	10 0 0	210–215	8000	10	Nictheroy, Brazil (Limited) . . .	10 0 0	3 10 0	6–8			Water Companies.			
125000	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	150–155	30000	5	Oriental (Calcutta).	5 0 0	9 10 0	8–8½	12000	100	Chelsea	100 0 0	6 0 0	144–147
50000	Sk.	Do., preference .	100 0 0	6 0 0	135–140	30000	5	Do., new shares .	3 0 0	9 10 0	2–2½ pm.	1800000	100	East London . . .	100 0 0	6 0 0	150–153
23406	10	European (Limited)	10 0 0	10 0 0	18–19	10000	5	Ottoman (Limited).	5 0 0	3 0 0	2½–3	8000	50	Grand Junction . .	50 0 0	5 0 0	74–77
12000	10	Do., new shares.	7 10 0	10 0 0	6–7pm.	17500	10	Parà (Limted) . .	10 0 0	7 0 0	4–5	5840	25	Do., ½ shares . .	25 0 0	5 0 0	37–37½
35406	10	Do., new shares .	5 0 0	10 0 0	5–5½pm.	27000	20	*Phœnix*	20 0 0	10 0 0	41–43	2160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	34–36
3797770*l.*	Sk.	*Gaslight & Coke* A.	100 0 0	10 0 0	213–216	5600000*l.*	100	Do., new	60 0 0	7 10 0	100–102	547960	100	Kent	100 0 0	8 0 0	175–180
1000000*l.*	Sk.	Do. B.	100 0 0	4 0 0	80–85	1440000*l.*	Sk.	Do., capitalized .	100 0 0	5 0 0	107–109	970	100	Lambeth	100 0 0	6 5 0	147–150
30000	10	Do. 5 per ct. pref. conv., 3rd issue.	all	5 0 0	20½–21	36000	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	32–34	1161	100	Do.	100 0 0	6 5 0	135–140
50000	10	Do. do., 4th do. .	6 0 0	5 0 0	8–8½pm.	7359	5	Singapore (Limited)	5 0 0	7 10 0	5½–5⅝	4475	100	Do.	100 0 0	7 0 0	185–195
50000	10	Do. do., 5th do. .	2 0 0	5 0 0	7½–8pm.	2000	5	Do., preference .	5 0 0	7 10 0	5½–6¼	400000	100	Do.	60 0 0	7 0 0	50–55pm
200000*l.*	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	225–230	1500	32½	Shanghai	32 10 0	12 0 0	30–32	3036	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101–103
300000*l.*	,,	Do. D do. do. .	100 0 0	10 0 0	225–230	4000	50	*South Metropolitan*	50 0 0	10 0 0	108–110	1296	100	Do., pref. stock .	100 0 0	4 0 0	101–103
165000*l.*	,,	Do. E do. do. .	100 0 0	10 0 0	225–230	4000	12½	Do.	12 10 0	10 0 0	26–28	..	100	Do., D shares . .	100 0 0	4 0 0	102–114
300000*l.*	,,	Do. F 5 do. do. .	100 0 0	5 0 0	113–116	20000	12½	Do., new shares .	9 0 0	10 0 0	11½–12½ pm.	..	..	Do., 4½ preference	100 0 0	4 10 0	105–107
600000*l.*	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	160–165							..	100	Do., new ordinary	..	4 10 0	106–108
1500000*l.*	,,	Do. H	100 0 0	7 0 0	148–152	15000	10	*Surrey Consumers.*	10 0 0	10 0 0	21–22	1600	100	Do., new ord. No. 1	40 0 0	4 10 0	106–108
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..	10000	10	Do., new	8 0 0	10 0 0	9½–10¼ p.	12172	61	West Middlesex . .	61 0 0	6*l.* p.sh.	135–138

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

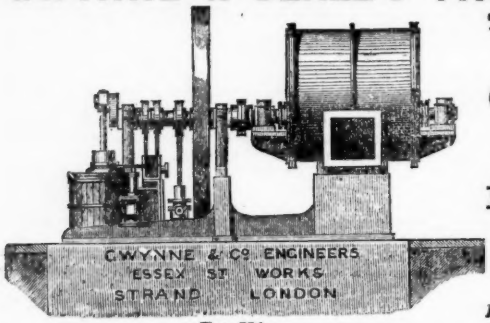


FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

GWYNNE & CO.

HAVE MADE THE

LARGEST AND MOST PERFECT

EXHAUSTING MACHINERY

Ever produced, and the most economical in working.

Prices and every information on application.

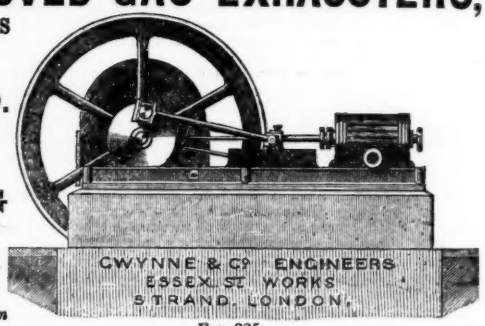


FIG. 225.

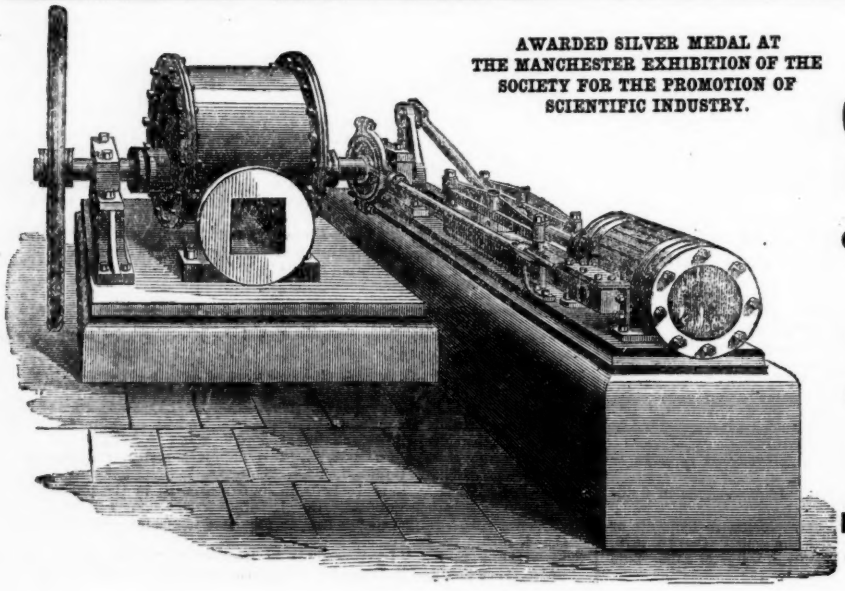
Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. Gwynne and Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 *cubic feet Patent Gas Exhausters, and many of all sizes.*



AWARDED SILVER MEDAL AT THE MANCHESTER EXHIBITION OF THE SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.

BEALE'S

Improved Patent

GAS-EXHAUSTERS

WITH

ENGINES COMBINED.

Sole Makers,

GEORGE WALLER & CO.

Makers of

ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHŒNIX ENGINEERING WORKS,

HOLLAND STREET, S.E.,

AND

STROUD, GLOUCESTERSHIRE.

WANTED, by a steady Man, a situation as WORKING MANAGER of a small Gas-Work. Can do all repairs and main and service laying.
Address GAS MANAGER, 15, Southam Street, Upper Westbourne Park, LONDON.

WANTED, a situation as Retort-Setter, either by day or piece work. Can produce testimonials from several Gas Companies.
Address E. D., 9, Warple Terrace, Warple Way, WANDSWORTH.

WANTED, by the Advertiser, aged 32, a situation as METER INSPECTOR, Fixer, Index Taker, &c.
Address M. G., care of Mr. Smith, 60, Cornwall Road, LAMBETH, S.E.

HEREFORD CORPORATION GAS-WORKS.

WANTED, a steady, active Man as FOREMAN STOKER, and to take charge of engine, &c. Wages 31s. per week.
Apply, in own handwriting, to WILLIAM DAVIS, Manager.
Nov. 4, 1876.

WANTED immediately, a steady, active Man as GAS MAKER, to take his turn in night and day work. Wages 25s. per week. House, coal, and gas found. None but steady, sober men need apply.
Address THOS. FORRETT, Manager, Gas-Works, Alfreton, DERBYSHIRE.

WANTED, by the Advertiser, aged 24, a situation as ASSISTANT MANAGER, or as Clerk and Collector, or Meter Inspector. Well acquainted with keeping Gas Companies Accounts and the collection of same. Good references. No objection to go abroad.
Address H. DIAPER, care of Mr. Ladd, Pitfield House, Slad Road, Stroud, GLOUCESTERSHIRE.

TO FOREMAN STOKERS.

WANTED immediately, in a suburban Gas-Work, where the make of gas is about 100 millions per year, a PERSON to act as above. He will have to take alternate duty, night and day. None but steady and trustworthy men need apply.
Applications, with testimonials, to be addressed to No. 325, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a provincial Gas Company, a first-class WORKING FOREMAN who thoroughly understands the manufacture of gas, and the machinery in connexion therewith. None but those steady, qualified, and accustomed to the management of men need apply. Wages 35s. per week. House, coal, and gas.
Address No. 324, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FARNWORTH AND KEARSLEY GAS COMPANY.

WANTED immediately, at the Gas-Works, in Farnworth, a WORKING FOREMAN, who has a thorough practical experience in the several departments of an extensive Gas-Work, and can take charge of the carbonizing and purifying departments, superintend the laying of mains, and act generally under the Manager. He must devote the whole of his time to the duties of the office.
Salary at the rate of £100 per annum, with house, coals, and gas free.
Applications, to be made by letter, addressed to the CHAIRMAN of the Directors, at the Works, in FARNWORTH, and to be accompanied by testimonials as to character and ability.

CHIEF INSPECTOR.

WANTED, by the Croydon Gas Company (having about 4000 meters and nearly 1000 public lamps), an active and experienced CHIEF INSPECTOR, or SUPERINTENDENT of the Outdoor Department. He will be required to have a thorough knowledge of main and service laying, gas-fitting, the testing and registration of meters, and the inspection of public lights.
Salary £150 per annum.
Applications, stating age and qualifications, with copies only of recent testimonials, to be sent to me on or before the 15th of November, 1876.
All applications not replied to by the 25th of November to be considered as declined.

By order of the Directors.
WILLIAM J. RUSSELL, Secretary.
Offices, 23, George Street, Croydon, Surrey,
Oct. 25, 1876.

LONDON AND NORTH-WESTERN RAILWAY.

THE London and North-Western Railway Company have for SALE Two GASHOLDERS (by Hick and Son), each about 34 ft. diameter, 20 ft. lift; with the necessary columns, girders, balance-weights, &c.
Seventy-seven D Retort Mouthpieces, with the necessary ascension-pipes and hydraulic main, and four groups of 6-in. condensing-pipes.
Also Four Purifiers, with dry centre-valve and connexions, each 10 ft. square, by C. and W. Walker, 1867.
The whole may be seen on application to Mr. F. W. Webb (the Company's Locomotive Superintendent, Crewe), who will give any information that may be required, and to whom tenders for the purchase should be addressed.

By order,
S. REAY, Secretary.
Euston Station, Oct. 27, 1876.

THE Advertiser, a practical, mechanical, and Gas Engineer, wishes for a SITUATION in a Gas-Works or a Gas and Water-Works, at home or abroad. Knows the best system of retort-setting and making sulphate of ammonia, and is well up in the different branches of out and in door and office work. Highest references and testimonials.
Address No. 320, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVANTAGES OF GAS FOR

COOKING AND HEATING.

HINTS ON GAS BURNERS, &c.

By MAGNUS OHREN, A.I.C.E., F.C.S.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works, Lower Sydenham, London, S.E.

DRAWINGS and Specifications for Gas-Works: Ironwork by a Gas Engineer, Buildings by an Architect. Terms moderate. Open also to treat for Leasing Gas-Works.
Address No. 319, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOILERS.

FOR SALE, Cheap, Two 5-h.p. Cornish BOILERS, in good condition. May be seen at the Reading Gas-Works.
Particulars can be obtained of Mr. E. BAKER, Engineer.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high.
Cast-iron Scrubber, 3 ft. diameter, 20 ft. high.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

BELFAST CORPORATION GAS-WORKS.

THE Gas Committee of the Belfast Corporation are prepared to receive TENDERS for the AMMONIACAL LIQUOR produced at their works, for such a term as may be agreed on, say Three, Five, or Seven years, from the 1st of July, 1877.
The quantity at present made is about 800,000 gallons per annum, and a considerable increase may be expected.
Sealed tenders, endorsed "Ammoniacal Liquor," and addressed to JAMES GUTHRIE, Esq., Town-Clerk, will be received up to Jan. 1, 1877, and all information may be obtained on application to JAMES STELFOX, Manager.

BELFAST CORPORATION GAS-WORKS.

THE Gas Committee of the Belfast Corporation are prepared to receive TENDERS for the TAR produced at their works, for such a term as may be agreed on (say three, five, or seven years) from the 1st of July, 1877.
The quantity at present made is about 500,000 gallons per annum, and a considerable increase may be expected.
Sealed tenders, endorsed "Tar," and addressed to James Guthrie, Esq., Town-Clerk, will be received up to Jan. 1, 1877, and all information may be obtained on application to JAMES STELFOX, Manager.

TO GASHOLDER MAKERS AND OTHERS.

THE Directors of the Altrincham Gas Company are prepared to receive TENDERS for the erection and construction of a Single-Lift GASHOLDER, 130 ft. diameter, at Hale Moss.
Plans and specification to be seen at the Company's Offices, Moss Lane, Altrincham, on and after Wednesday, the 25th inst.
Tenders to be addressed to the Chairman of the Gas Company, not later than the 15th of November.
The Directors do not bind themselves to accept the lowest or any tender.

BY ORDER.
Altrincham, Oct. 20, 1876.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

BAHIA GAS COMPANY, LIMITED.
NOTICE is hereby given that the ORDINARY HALY-YEARLY GENERAL MEETING of this Company will be held at the Company's Office, 10, Coleman Street, London, on TUESDAY, the 14th day of November, 1876, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for general purposes.
The chair will be taken at Three o'clock precisely.

By order of the Board,
ALFRED J. HEAD, Secretary.
Oct. 31, 1876.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)
NOTICE is hereby given that the HALF-YEARLY ORDINARY MEETING of the Proprietors of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 28th inst., at Two o'clock in the afternoon precisely, when a Report will be made to the Proprietors, a Dividend declared for the half year ended the 30th of June, 1876, and the usual ordinary business of such meeting transacted.
Notice of motion given at the last Meeting for increasing the remuneration of the Directors will also be considered.
Notice is also hereby given that the Transfer Books of the Association, and the Register of Shareholders, will be closed on Tuesday, the 14th inst., and will remain closed until after the Half-Yearly Ordinary Meeting on the 28th inst.

By order of the Board of Direction,
ALBERT F. JACKSON, Secretary.
No. 30, Clement's Lane, Lombard Street,
London, Nov. 6, 1876.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

COAL TAR.

THE Directors are prepared to receive TENDERS for the surplus TAR produced at the works of the Association, at Vienna, Austria, during Two or Three years, commencing the 1st of May next, the quantity being about one million gallons yearly. Payments to be made monthly. Contractors will be required to find security for the performance of their contract.
The Directors do not bind themselves to accept the highest or any tender.
Offices, 30, Clement's Lane, Lombard Street, London, to which all replies are to be addressed.

By order,
ALBERT F. JACKSON, Secretary.
Oct. 19, 1876.

APPLICATION OF THE METER SYSTEM TO PUBLIC LAMPS.

THE Vestry of the Parish of St. George, Hanover Square, require TENDERS for the supply of METERS, METER-BOXES, and REGULATORS, for the application of the Meter System to about 1700 lamps; and for the maintenance of the same; also for the maintenance, &c., of the lamp-columns, &c.
Copies of the specification, bills of quantities, and forms of tender, may be had, on application, from the Surveyor, at his Office, No. 1, Pimlico Road, S.W.
Tenders to be sent in, sealed and endorsed, to the Vestry Clerk, at the Board Room, Mount Street, Grosvenor Square, on or before Saturday, the 11th of November next.
The Vestry do not bind themselves to accept the lowest or any tender.

By order,
J. H. SMITH, Vestry-Clerk.
Oct. 26, 1876.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

16th edition, 1000 engravings, 4to., post free 3s. 6d. in stamps, weight 10 oz., cost of production £1000,

BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine; (4) Turret Clock, &c.; (5) Electric Telegraph, A B C Instruments, Bells, and Apparatus.
W. H. BAILEY and Co., Albion Works, Salford, LANCASHIRE.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF **WET AND DRY GAS-METERS;**
Patentees and Sole Manufacturers of PEEBLES' LAMP-GOVERNORS,
ABOVE 30,000 OF WHICH ARE NOW IN USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*
D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

GAS-WORKS CLAUSES AMENDMENT ACT, 1871.

ANNUAL ACCOUNTS OF GAS COMPANIES.

FORMS OF ANNUAL ACCOUNTS, arranged as required by the 35th Section of the Act (34 & 35 Vict., cap. 41), are now ready.

These Forms have been printed on large sheets of paper of the best quality, and are carefully ruled so as to afford the utmost facility for compliance with the provisions of the Act.

Price 3s. 6d. per dozen, free by post, or may be ordered of any Bookseller.

LONDON: W. B. KING,
11, BOLT COURT, FLEET STREET, E.C.

A Specimen Sheet on receipt of Six postage stamps.

T. NEWBIGGING,
CONSULTING GAS ENGINEER,
5, NORFOLK STREET, MANCHESTER.

HENRY LYON,
ENGINEER,
AND
CONSULTING GAS ENGINEER,
BROOKLYN, CHEETHAM HILL ROAD,
MANCHESTER.

Mr. ALFRED LASS,
30, GRACECHURCH STREET, LONDON, E.C.,
Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.
To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.
To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c, supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

JAMES WHITFIELD,
CLARINGTON BROOK FORGE AND IRON FOUNDRY,
WIGAN, LANCASHIRE.

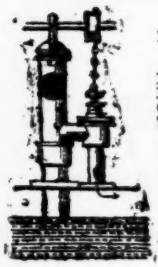
CAST & WROUGHT IRON WORK,
ALSO
FIRST QUALITY RETORT AND OTHER SHOVELS FOR GAS-WORKS.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.

T. BUGDEN, Manufacturer,
79, GOSWELL ROAD, LONDON, E.C.

COPP'S PATENT ANTI-DIP GAS APPARATUS.



Produces from 10 to 20 per cent. more gas of higher illuminating power.
Prevents the deposit of carbon.
Retorts last much longer.
Charges work off quicker.
This simple invention has been in use in many works for the last six months, with the above results.

PRICE 2 GUINEAS EACH.

Testimonials and particulars on application.
Address **WALTER L. COPP,**
WATCHET, SOMERSET.

On the 25th of November will be published, price One Shilling, No. 1 (to be continued Monthly) of

A TREATISE ON THE SCIENCE & PRACTICE OF THE Manufacture and Distribution OF COAL GAS.

As the "Treatise" will be printed in a very superior style, and will contain numerous engravings on thick paper, it cannot be sent through the post without damage. Our friends will therefore have to order the numbers through their local booksellers, by whom they will be regularly supplied.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET.

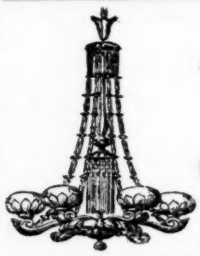
Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, A.I.C.E.

Orders to be sent to the Publisher,

WILLIAM B. KING,
11, BOLT COURT, FLEET STREET, LONDON, E.C.



F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

ALFRED WILLIAMS,
PHŒNIX FIRE-BRICK WHARF,
64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

GEORGE ORME & CO.,
ATLAS METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS.
STATION-METERS, GOVERNORS,
PRESSURE AND EXHAUST REGISTERS,
LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

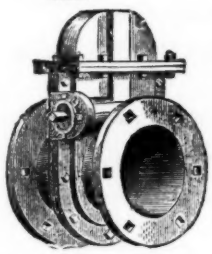
STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

B. DONKIN & CO.'S IMPROVED GAS-VALVES

TRADE MARK

WITH WROUGHT-IRON PINIONS,



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

VALVES MADE WITH OUTSIDE RACKS TO ORDER.

ALSO, SCREW WATER-VALVES WITH GUN-METAL FACES.

ALSO SOLE MAKERS OF

J. BEALE'S NEW PATENT GAS EXHAUSTERS.

B. DONKIN & CO.,

GENERAL ENGINEERS AND IRONFOUNDERS,

MAKERS OF STEAM-ENGINES,

55a, BLUE ANCHOR ROAD, BERMONDSEY,

LONDON, S.E.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

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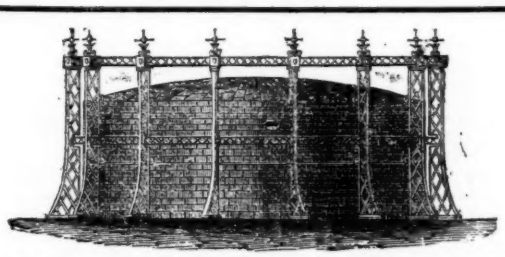
GOWTS BRIDGE WORKS,

LINCOLN.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—It is most particularly requested that all Communications be addressed to the FIRM ONLY, as circumstances have arisen which render this necessary.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

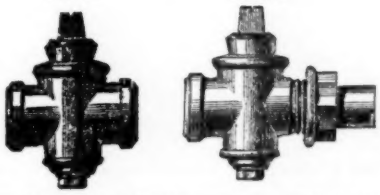
Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

LAMBERT'S CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

TORBAY AND DART PAINT COMPANY, LIMITED.

WORKS:

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SOLE PROPRIETORS AND MANUFACTURERS OF

WOLSTON'S CELEBRATED

TORBAY IRON PAINTS.

(ESTABLISHED 1851.)

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Waggon Works, and the Paint Trade generally. They are the BEST PROTECTORS of IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to ironwork. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only before use to be thinned down in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

PRICES and TESTIMONIALS on APPLICATION.

GARSIDE'S IMPROVED MAIN DRILLING CLIP.

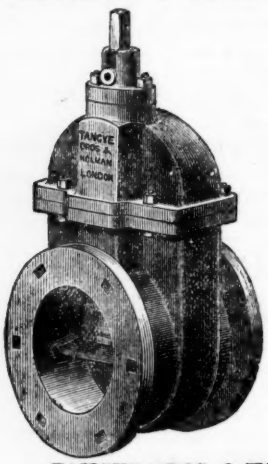
No. 1 takes from 2-in. to 6-in. Mains.
No. 2 takes from 6-in. to 12-in. Mains.
GARSIDE'S REGISTERED TUBE-VICE takes ⅜ brass to a 2-in. Socket.
May be had direct from the maker, SAMUEL GARSIDE, Gatefield Iron-Works, ASHTON-UNDER-LYNE.

GAS COMPANIES AND LOCAL BOARDS Requiring New Street-Lamps are recommended A **KEEN'S PATENT DOUBLE-CLIP STREET-LAMP.** B

A great improvement on the old-fashioned 14-in. Lamps. They have been sold to various Gas-Works throughout the country and abroad, and the highest satisfactory testimonials are given as to their superiority. For particulars of price, &c., apply to

WILLIAM KEEN, Sole Proprietor and Manufacturer, Robertson Street, HASTINGS.

IMPROVED
GAS-VALVES.



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TANGYE BROS. & HOLMAN, LAURENCE POUNTNEY LANE, LONDON.

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GAS AND CONSULTING ENGINEER,

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PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.
FUEL-MACHINE, for Compressing Breeze and Tar.
WASHERS, SCRUBBERS, and PURIFIERS, that Economize Space and Cost.

N.B.—Pamphlet, with Eighteen Illustrations of the foregoing, with letterpress on the construction of Gas-Works, post free, 2s. 6d.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS, VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

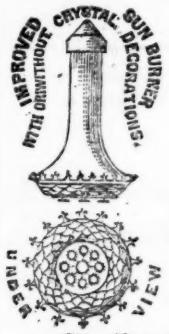
AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.



GAS MOONS, Cut and Engraved, of the newest designs

GAS REFLECTORS In Silver and Glass

GAS NIBS AND BURNERS Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.
ESTABLISHED 1830.

WHITAKER'S
PATENT RETORT CHARGING APPARATUS

(NOW AT WORK AT WAKEFIELD GAS-WORKS)

Effects a Great Saving in Labour, estimated at about £2 per Mouthpiece per Annum; Renders Gas Companies less Dependent on Skilled Stokers; Makes a Charge Evenly and Quickly, and Prevents Waste of Gas; and can be Supplied and Erected at £2 10s. per Mouthpiece, including Royalty.

FOR FURTHER PARTICULARS, APPLY TO THE SOLE LICENSEE,

EDMUND ROBINSON,

CITY BUILDINGS, CORPORATION STREET, MANCHESTER,
WHERE A WORKING MODEL MAY BE SEEN.

N.B.—*The above Advertisement will appear in the first* JOURNAL OF GAS LIGHTING *in each Month.*

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL—1, Back Leeds Street,

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

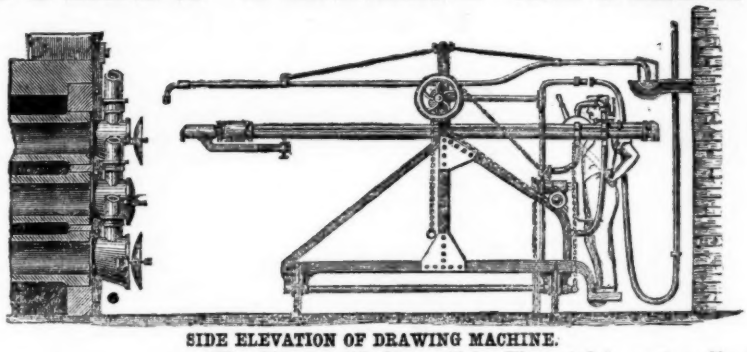
IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

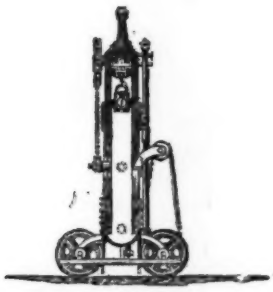
And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(*The Charging Machine will be Illustrated in next week's Advertisement.*)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz: Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

THOMAS ALLAN & SONS,

IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

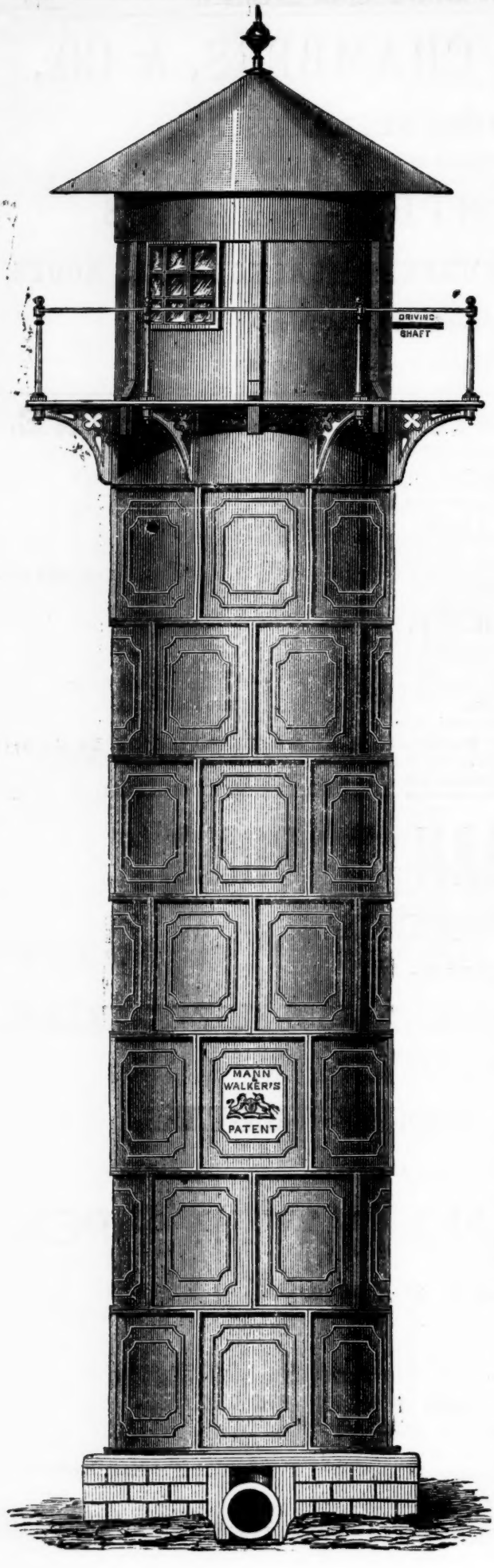
SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

London Agent: Mr. A. C. FRASER, ST. STEPHEN'S CHAMBERS, TELEGRAPH STREET.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

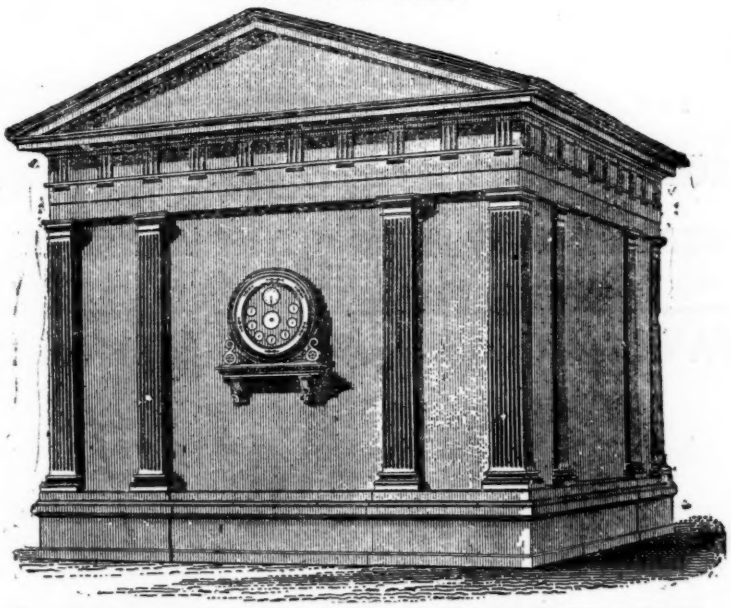
Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

J. EDMUNDSON & CO.,
19, GREAT GEORGE STREET, WESTMINSTER,
LONDON, S.W.,
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.
CONTRACTORS FOR THE
ERECTION OF GAS-WORKS, GAS-FITTINGS, &c.,
FOR TOWNS, COUNTRY MANSIONS, &c.
Estimates given free of Charge.

J. & J. BRADDOCK,
GAS ENGINEERS,
GLOBE METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET & DRY CONSUMERS GAS-METERS,
OF THE HIGHEST EXCELLENCE ONLY;
ALSO LICENSEES AND MANUFACTURERS OF
WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;
ROUND STATION-METERS,
ON CAST-IRON STANDS.



SQUARE STATION-METERS,
WITH PLANED JOINTS.
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GAS COOKING APPARATUS.
Home and Foreign Orders promptly attended to.
All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.
Orders almost invariably despatched on the day of receipt.
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ALFRETON IRON-WORKS, DERBYSHIRE,
AND
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CITY ROAD, LONDON, N.,
Keep in London and at their works large stocks of PIPES and CONNEXIONS (1¼ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
CHARLES HORSLEY, Agent.

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NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of
CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

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MANUFACTURERS OF
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CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
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WOOD PURIFIER SIEVES,
Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.
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CATOPTRIC
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The NEW PATTERN
Is now placed throughout
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ALBERT GAS COAL.

THE DERBYSHIRE
SILKSTONE COAL COMPANY,
LIMITED,
CAN OFFER A
GAS COAL
Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

ANALYSIS AND PRICES ON APPLICATION TO
Mr. EDMUND TAYLOR, Secretary,
ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

SCOTTISH CANNEL COAL SUPPLY AND GAS ENGINEERING ESTABLISHMENT, EDINBURGH.

In consequence of Mr. WILLIAM ROMANS having accepted the appointment of Engineer-in-Chief to the Sheffield Gas Company, the firm of J. and W. Romans, Gas Engineers and Coal Factors, is dissolved, and Mr. John Romans, C.E., F.G.S.E., is again Sole Proprietor.

Mr. Romans, in resuming the direction of this old-established business, desires to embrace the opportunity of inviting the attention of Corporations and Gas Companies to the great importance of a skilful selection of the Cannel and Coal to be carbonized. It is a fact known to those who have patiently manipulated the distillation of gas from Cannel and other Coals, with a view to obtain the highest economic results, that by a judicious intermixture of the lighter with the heavier gases, much of the rich hydrocarbons are saved, which otherwise would be lost during the process of manufacture.

It is with the experience of over 30 years continuous observation to this essential branch of science that Mr. Romans ventures to place at the disposal of his friends, Corporations, and Gas Companies at home and abroad, the practical knowledge he has thus acquired in the basis of gas manufacture and its residual products. Also upon all matters appertaining to the mechanical department of Gas-Works, he is, as a bred engineer, prepared to advise or contract for the supply or repair of the apparatus, or overlook and attest its construction for exportation.

OFFICES:
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N.B.—Mr. Romans has no INTEREST in, nor is he AGENT for, any special Colliery.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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GAS-RETORTS, GLASS-HOUSE FURNACE,
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THE ORIGINAL MANUFACTURER OF
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WITH TAPER BARS,
MADE BY MACHINERY
CAPABLE OF MAKING 10,000 FEET WEEKLY.
References to Hundreds of First-Class Engineers.
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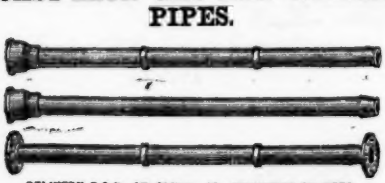
CAST-IRON GAS AND WATER PIPES.



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Prices on application.

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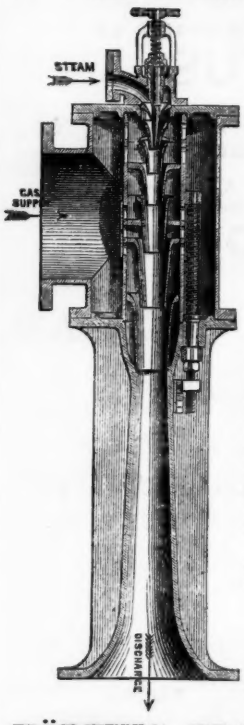
France: 11, Rue Louis-le-Grand, Paris. U. S.: 1645, N. 10th St., Philadelphia.



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STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
Small Cost—Compactness—Perfectly Self-Acting—
Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—
No Extra Room Required—No Wear and Tear—No Noise—
No Oscillation in Vacuum, or Back Pressure.

UPWARDS OF 200 IN USE.
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Chartered Gas Co.	Glasgow Corporation.	Hanna, Donald, and Wilson, London.
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Liverpool Gas Co.	Birmingham Gas-Works.	Dartford Gas Co.
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Ipswich Gas Co.	Guildford Gas-Works.	Waterside Gas-Works, Todmorden.
Cheltenham Gas Co.	Gloucester Gas-Works.	F. W. Grafton and Co., Accrington.
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E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.

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Combining small cost and thorough efficiency, with absence of any mechanical means and necessity of renewing the scrubbing material.

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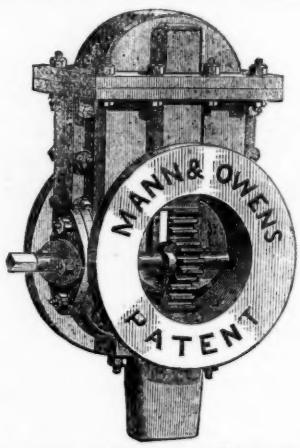
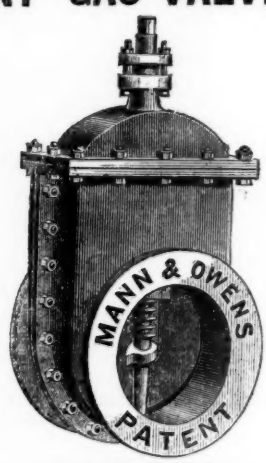
MANN & OWENS' PATENT GAS-VALVE.



RACK AND PINION VALVE.



SCREW VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

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LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12¾ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

HEBBURN MAIN GAS COALS.

Cubic feet of Gas yielded per ton . . .	10,050
Illuminating power in sperm candles . .	15·4
Yield of coke per ton of good quality . .	13¾ cwts.

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W. RICHARDSON, Fitter,

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

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COPPA COLLIERY, MOLD,

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

G. J. EVESON,

GAS COAL MERCHANT,

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Delivery per Rail to any Part.

"SELLARS' CEMENT"

PREVENTS WASTE OF GAS FROM RETORTS;

SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;

GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;

And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.

J. C. SELLARS,

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REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

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Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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DRY GAS-METERS,

PRIZE MEDALS.
LONDON, 1851;
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(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

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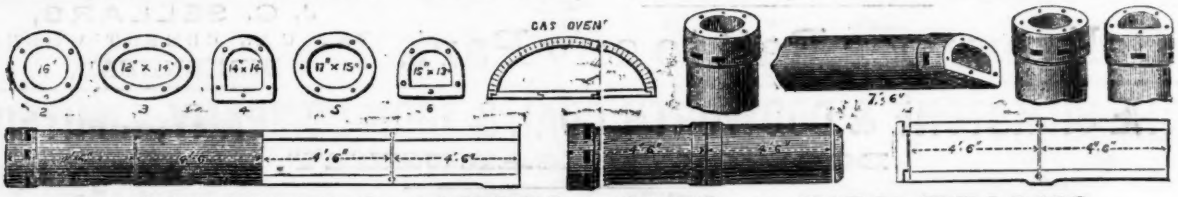

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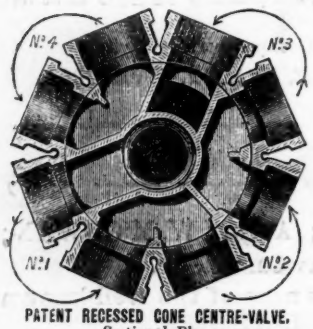

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Sectional Plan.

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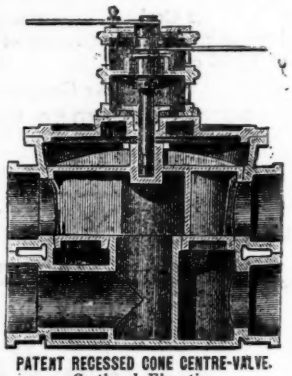
RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
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Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

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Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.

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